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PLATE I. .

BUCCAL ENANTHEM IN MEASLES (KOPLIK'S SPOTS.)

(Courtesy Dr. John Zahorsky.)

THE DISEASES OF CHILDREN

2767

BY

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WITH ONE HUNDRED AND SIX ENGRAVINGS
AND THREE COLORED PLATES

SECOND REVISED EDITION

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1913

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1913

THIS BOOK
IS AFFECTIONATELY DEDICATED
TO
MY WIFE
WHOSE LIFE HAS BEEN A CONSTANT
INSPIRATION TO HIGHER ENDEAVOR

1 1 1

1 1

PREFACE TO FIRST EDITION.

This book has been written not for the specialist, but with the needs of the general practitioner and student in view, and the diseases of children have been described as they are seen by the busy practitioner in his daily rounds.

Believing that the question of infant feeding is one of the most important which confronts us, much more space has been devoted to that subject than is given other important ones. We wish to interest the general practitioner in milk, its care and handling, the necessity for the formation of certified milk commissions, and the establishment of milk depots where certified milk may be placed within the reach of the poor.

Each disease is considered in a methodical manner. Special attention is given the dietetic and hygienic management, and the medicinal treatment is considered quite fully, with the reproduction of many tried formulæ.

Chapters have been included on Diseases of the Eye, Ear, Nose and Throat, and the Skin.

Temperature charts have been reproduced in a number of places, with the hope that this valuable clinical aid will be more often employed in private practice than it is at present. A world of valuable data and statistics is lost because of the practitioner's failure properly to record bedside notes in daily visits to the private patient. We would encourage this feature of the work.

Thanks are herewith extended to Dr. Wm. Britt Burns, of Memphis, for the preparation of the chapter on Malaria; to Dr. Louis Frank and Dr. I. Lederman for valuable suggestions; to Mrs. Mary West Fullenlove for painstaking preparation of the manuscript, and to the publishers for their many courtesies during the publication of the book.

HENRY ENOS TULEY.

PREFACE TO SECOND EDITION.

The retirement of the Southern Medical Publishing Company from the field of book publishing, and the acquirement of the publication rights to this book by the C. V. Mosby Company, necessitated the entire resetting of the book when it became apparent a second edition was needed. This has enabled the author to rewrite many chapters and make additions throughout the text that became necessary because of advancements and discoveries in pediatrics since 1909. Advantage has been taken also of this opportunity to make many corrections in the make-up of the book, as many typographical errors crept into the first edition.

The general character of the book has been kept the same. The needs of the general practitioner and student have been kept in the front always and as far as possible the views of the authorities in diseases of children have been given as well as the experience and observation of the author.

New food formulæ have been added and the suggestive standards and methods for the production of Certified milk as adopted by the American Association of Medical Milk Commissions have been reproduced in full in the appendix, believing they may prove of value to many who may contemplate organizing a medical milk commission, or help to make better commissioners of those already members of one.

The old classification of the diseases of the gastro-intestinal tract has been retained with the full knowledge of its being unsatisfactory, but in the absence of a better one it was thought best to adhere to the old.

A number of new illustrations have been added to this edition, some to take the place of ones which had been lost, others entirely new. We are indebted to several authors and medical journals for the use of special cuts.

Advantage is taken of this opportunity to express my thanks

PREFACE TO SECOND EDITION.

to the Publishers for their many courtesies, to my secretary, Miss Alice Lee Ford, for her invaluable assistance in the preparation of the manuscript, and for the generous reception accorded the first edition, which we bespeak for the second edition as well.

HENRY ENOS TULEY.

Aug. 1st, 1913.

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THE DISEASES OF CHILDREN

CHAPTER I.

ANATOMY OF INFANTS.

The infant's anatomy differs from that of the adult in many essential points. The chief of these is the change which takes place in the *circulation* immediately after birth. These may be named as follows, probably in the order of their happening: Opening of the pulmonary arteries; closure of the foramen ovale, complete about the tenth day; disappearance of the Eustachian valve; obliteration of the ductus arteriosus, ductus venosus and the hypogastric arteries, the latter remaining pervious from the internal iliac arteries to the bladder, known after birth as the superior vesical arteries. The umbilical vein and the ductus venosus close about the fifth day, the latter persisting in its impervious state as the round ligament of the liver. With the tying of the cord the hypogastric arteries and the vessels in the cord are obliterated.

The child's *head* is very soft and compressible, the bones are ununited and separated by *sutures*; where the sutures coalesce are the anterior and posterior *fontanelles*. The anterior fontanelle, at the anterior superior end of the parietal bones is larger than the posterior and quadrilateral in shape. It closes during the second year. The posterior fontanelle at the posterior inferior ends of the parietal bones is triangular in shape and smaller. It closes by the end of the first year.

As a result of *moulding* during birth the head in normal cases is much elongated from the chin to the occiput, and if a large *caput succedaneum* is present it is still further misshapen. Its normal contour is restored in a few days. The scalp is quite mobile, owing to its loose attachment to the aponeurosis. The *frontal bone* is divided into two equal parts by the frontal suture.

The *sphenoidal* and *temporal* bones consist of three separate pieces each. The *mastoid cells* are not present. The *inferior maxilla* is divided into two equal portions united by fibrous tissue at the chin.

The infant's *ear* differs greatly from the adult's. At birth the axis of the meatus is directed upward, the canal being smaller at the inner end. The auricle is pulled downward to obtain a view of the tympanum.

The *Eustachian tubes* in the infant are about half the length of the adult's; they are straight, and nearly horizontal, and the pharyngeal opening is about on a level with the hard palate, and smaller, relatively, than in the adult.

The *nose* is small in infancy and the respiratory space in the nares very limited. The *nasopharynx* is quite deep. It is vascular and rich in lymphoid tissue. The presence of this lymphoid tissue is a menace to infants as it becomes easily inflamed and swollen, obstructing the respiratory area.

The spine is very flexible, the bones at birth are mostly cartilaginous, the nuclei of ossification being present. *Spina bifida* results from a failure of the laminæ to unite allowing a protrusion of the membranes of the cord or filaments of the cord itself. The *upper extremities* are much better developed at birth than the lower, the fetal circulation providing a venous blood to the *lower extremities*.

The *clavicle* is one of the first bones to ossify. The ossification of the long bones begins in the center of the diaphysis. The bones of the *thorax* are mostly cartilaginous, hence, the elasticity of this portion of the body. Several centers of ossification are present in the *sternum*. The *larynx* is higher than in the adult, being about on the level with the axis, and a view of the epiglottis and vocal cords can frequently be had without the aid of a mirror.

The *trachea* divides at about the third lumbar vertebra. The opening into the right lung is larger than the left, the right bronchus not having quite so wide an angle.

The *lungs* at birth are small and the air vesicles entirely collapsed. On removing the anterior chest wall of a still-born child the lungs do not fill the thoracic cavity and the heart is

found uncovered, the thymus gland extending usually below the base of the heart. As a result of the first deep inspiration the air vesicles are dilated, the lungs expand, fill the cavity and cover the heart. The division of the right lung into three lobes is quite marked in the infant, with a deep fissure especially posteriorly between each. The lower border of the right lung posteriorly, reaches the tenth rib on the right side, and to the eleventh rib on the left side.

The *thymus gland* is an organ but little understood. It is present in the new-born, often being relatively of great size, gradually growing smaller after birth. It may extend as low as the fourth rib, and above the suprasternal notch. It has two lobes, and may measure $2\frac{1}{2}$ by $1\frac{1}{2}$ inches. Its undue development has been supposed to be the cause of some otherwise unexplained cases of sudden death.

The *bronchial glands* are located around the trachea in its lower portion and extend around the bronchi at their bifurcation. These are normally quite small, but as a result of an infection may assume quite a large size.

The *fetal heart* differs from that of the new-born in the presence of the interauricular opening, the foramen ovale, and the Eustachian valve, which is supposed to guide the blood from the inferior vena cava through the right auricle into the left auricle. The cavities of the right side are larger than the left, the heart weighing about two-thirds of an ounce, at birth. With the change in the circulation after birth the heart assumes more the adult type, the left side becoming larger. The apex beat is felt about the fourth interspace farther to the left than in the adult.

The *fetal circulation* is as follows: Leaving the placenta the blood flows through the umbilical vein to the umbilical opening, ascending to the under surface of the liver from there through the ductus venosus, a fetal structure, to the inferior or ascending vena cava. From the inferior vena cava the stream goes into the right auricle guided by the Eustachian valve through the foramen ovale into the left auricle. From the left auricle through the mitral orifice to the left ventricle; from the left ventricle to the ascending aorta, through the larger ves-

sels of the neck to the brain and upper extremities. The blood returns, via the superior or descending vena cava, to the right auricle, being largely venous in character; from the right auricle to the right ventricle, the pulmonary arteries being impervious, the blood is carried through the ductus arteriosus, a fetal structure, to the descending aorta. Through the descending aorta the blood flows as far as the iliac vessels, a portion of it going through the external iliac to the lower extremities, the rest of the blood going through the hypogastric arteries, branches of the internal iliacs, over the summit of the bladder and under the anterior abdominal wall to the abdominal opening where these vessels become the umbilical arteries.

The umbilical opening may be patulous at birth and allow a protrusion through into the cord of a loop of the intestine, or there may be a separation of the umbilical ring after the stump of the cord falls off allowing a protrusion of intestine and the formation of an *umbilical hernia*. There have been a few cases reported where a coil of intestine had been included in a ligature which encircled the cord to tie the umbilical vessels.

The *stomach* at birth is more like the dilated end of the esophagus than a separate organ itself, due to the pyloric end being pushed downward by the left lobe of the liver, causing it to assume more of the upright position. Regurgitation of its contents is very easy because of this. The stomach at birth will hold about 1 ounce. The cardiac opening is located about opposite the first dorsal vertebra, the principal difference in the intestine is the relatively large size and length of the sigmoid flexure of the colon.

The *sigmoid flexure* at birth is about as long as the colon itself, the sigmoid extending frequently much beyond the median line. Owing to the shallowness of the pelvis most of the sigmoid is in the abdominal cavity.

The *liver* is one of the heaviest organs in the body at birth, its relative weight to that of the body being 1 to 18. Its growth and development are due to its receiving first the pure arterial blood as it comes from the placenta. The left lobe may extend much beyond the median line.

The *spleen* is small at birth, lying usually under the ninth

and tenth ribs, and cannot be felt upon palpation unless enlarged. The *kidneys* are about on a line with each other. They are distinctly lobulated and may be joined, forming a horseshoe kidney. On section a number of uric acid infarcts may be found.

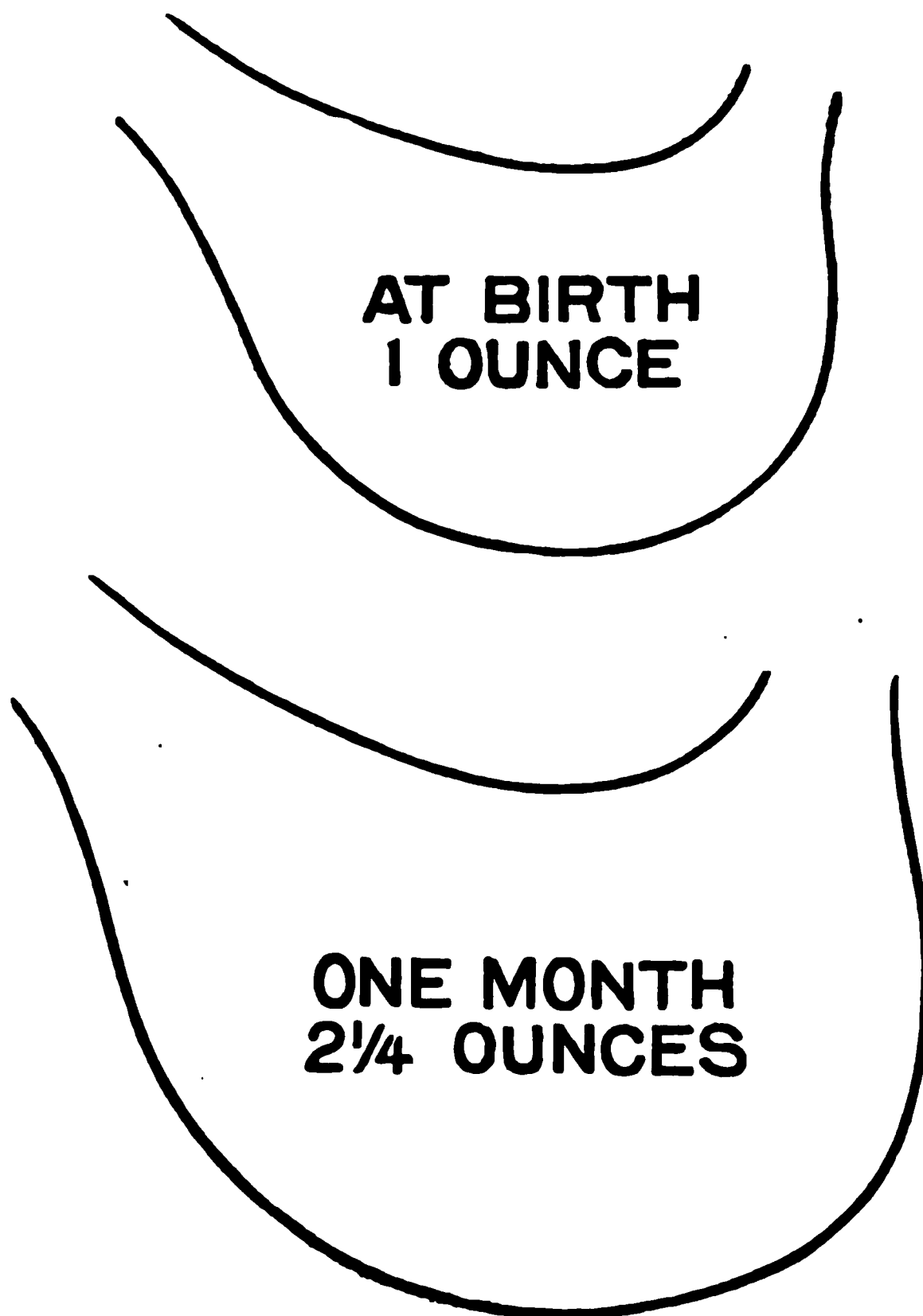


Fig. 1.—Capacity of infant's stomach (Kelley).

The *suprarenal glands* are relatively larger at birth than in the adult. They are highly vascular and may be the site of hemorrhage. (See report of case on page 46.) The male *urethra* will average two inches in length and shows quite a distinct constriction at the meatus. The fossa navicularis is relatively

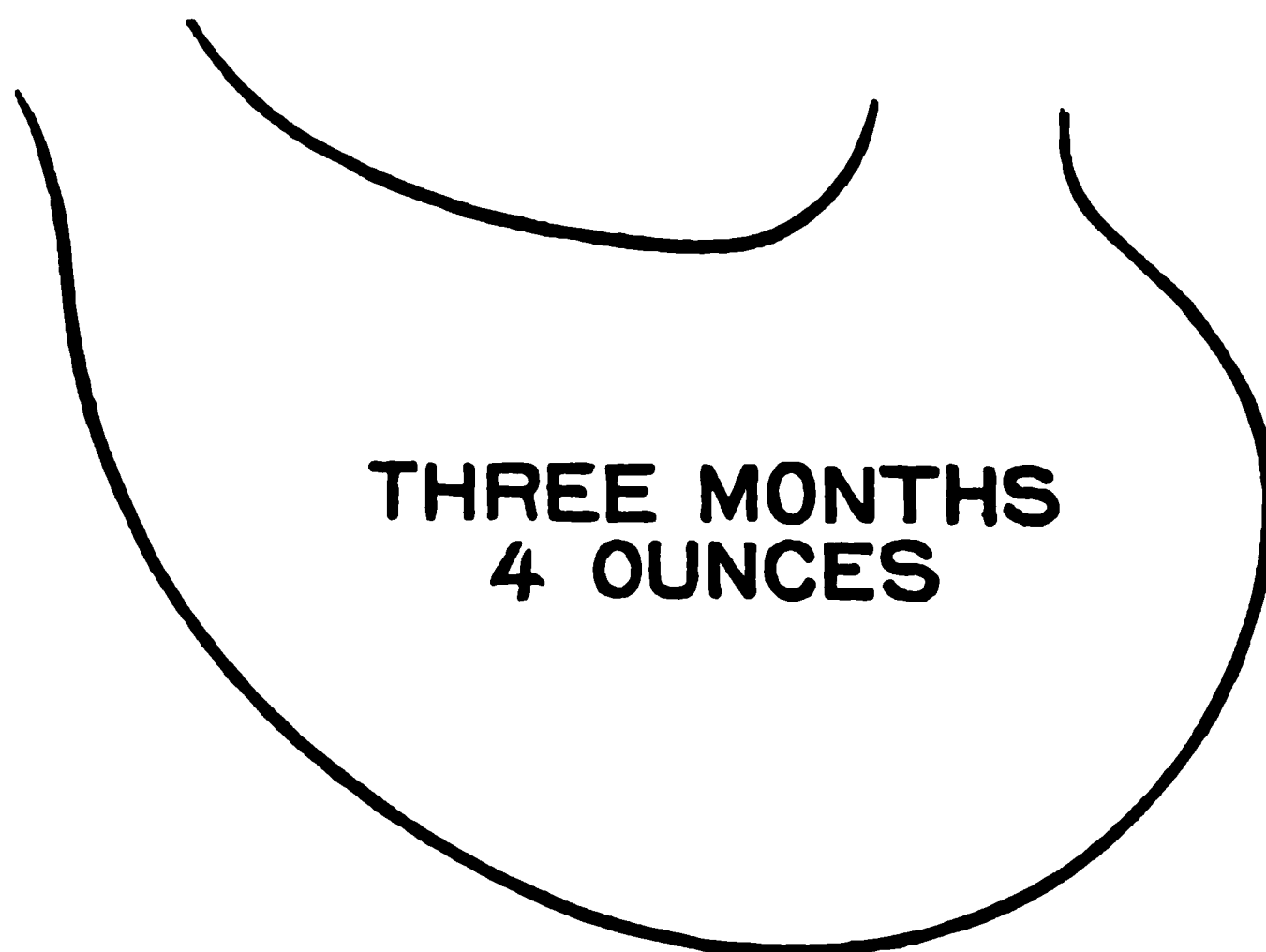


Fig. 2.—Size of infant's stomach three months (Kelley).



Fig. 3.—Size of infant's stomach six months (Kelley).

larger than the rest of the urethra and may be the site of the formation of a concretion or stone in late infancy.

The corona glandis is tightly covered by the prepuce, frequently adherent, with an accumulation of smegma behind the corona glandis.



Fig. 4.—Dissection of still-born child. Note the course of the sigmoid, also the relatively large size of the liver.

The *testicles* in the embryo are found in the abdominal cavity, below the kidneys, in the lumbar region. At about the eighth month they descend and pass out into the scrotum through the inguinal canals.

A child whose testicles are retained within the canal or cavity

is called a *cryptorchid*, if only one has descended, a *monorchid*.

The *uterus* at birth is small, about 1 inch in length; the *ovaries* are found in the lumbar region in intrauterine life, and at birth are as low as the brim of the pelvis. It is estimated that upwards of 75,000 ova are in each ovary at birth.

The relative weight of the *brain* at birth to the body is 1 to 8. The color is quite pale and contains a larger percentage of water than the adult brain.

HETEROTAXIA.

Irregular malpositions of viscera are occasionally observed in routine practice. These abnormalities have been exhaustively studied by Ballantyne, Osler, Arneill, Royer and Wilson.

The usual form observed is a complete transposition, of either the thoracic or abdominal organs or both.

Among the remarkable cases on record (Arneill¹ reporting 300 collected from the literature) are maintenance of fetal vascular conditions after birth; lobulated spleen or multiple spleens; one kidney; transposition of the cavities of the heart; of the lungs, liver and spleen.

The fetal condition of the heart can be made out by physical examination. The other transpositions may not be suspected until found postmortem, and unless the heart is involved the child may reach adult life; with involvement of the heart these children rarely reach puberty.

¹ American Journal Medical Sciences, November, 1902.

CHAPTER II.

THE NEW-BORN.

As soon as the child's head is born, and before the birth of the body, feeble attempts are made at inspiration. At this time the mouth should be wiped out promptly and freed of the mucus and fluid which it contains in order to prevent its being aspirated in the bronchial tubes, with the first deep inspiration.

Reacting to the stimulus of the air upon the skin, the first inspiration is taken and the air vesicles are dilated. The skin quickly changes from a pallid or bluish color to the normal red, and the child cries lustily. The respirations at first are shallow, often slightly irregular, and they are of the abdominal type. The chest soon becomes fully expanded and the number of respirations which at first was 60 or 70 to the minute will average about 40 at the end of the first hour.

ASPHYXIA.

Where insufficient air has entered the lungs of the new-born to dilate the air vesicles the child is *still-born*. When some air does enter the lungs and for any reason there is an interference with the proper exchange between oxygen and carbon dioxide, the condition is called *asphyxia*.

Forms.—Asphyxia may be intrauterine. This form is caused by any interference with the uteroplacental circulation; as a premature or accidental separation of a portion of the placenta; knots in the cord, too tight loop or loops of the cord around the child's neck; long-continued labor from any cause; compression of the cord by the after-coming head; compression of the fetal brain by forceps operation; death of the mother and prematurity.

Intrauterine asphyxia may be foretold by the premature escape of meconium in vertex presentations and by an interruption in the beat of the fetal heart, either very rapid or very slow heart sounds. In interference with placental respiration,

the blood of the fetus is surcharged with carbon dioxide, an increased intestinal peristalsis and a relaxation of the sphincter occurs, allowing escape of the meconium. In breech presentation, the escape of meconium is from pressure causes entirely, and is of no significance.

If premature respiration occurs before the birth of the head, liquor amnii and mucus may be aspirated, which will mechanically act as a cause of asphyxia.

The persistence of the intrauterine apnea after birth constitutes the postnatal form of asphyxia. The chief cause of this form is an injury to the respiratory centers by prolonged labor; prematurity, the thin chest walls making it impossible for the lungs to dilate because of external atmospheric pressure, a general atelectasis following in these cases.

Symptoms.—In the intrauterine form of asphyxia, the child is born limp and the skin is pale or blue. Two forms are generally referred to, asphyxia livida and asphyxia pallida, the latter being the most profound. In the mild cases there is a very feeble intake of air, noted by slight movement of the diaphragm, strong umbilical pulsation and muscular action of the face and nose. If improvement follows, the respirations will become more regular and less spasmodic, the color will improve and the child will utter a feeble whine or cry.

Prognosis.—The prognosis in all cases of asphyxia is very grave. Atelectasis is always to be feared. If the child does not nurse well, has a persistent subnormal temperature and progressive and rapid loss in weight, the prognosis is more grave. As long as there are any heart beats to be heard one should persist in efforts at resuscitation by artificial respiration.

Treatment.—Prophylaxis of asphyxia should be borne in mind in every case of labor. Intelligent interference in cases of prolonged labor with the fetal heart as a guide is always indicated, and will prevent many cases of asphyxia. The mouth and nose should be carefully cleansed of mucus and the face not allowed to remain in the discharges upon the bed or table, if the delivery is accomplished in the dorsal position. A basin or tub which will hold enough water to completely cover the child's body, should be part of the equipment of every delivery room, as fre-

quently respiration will be stimulated by immersing the child in water at a temperature of 105° or 110° F., and occasionally allowing a small quantity of cold water to trickle over its chest or plunging it for a second in cold water. If this fails, resort should be had at once to the use of one of the methods of artificial respiration.

A soft catheter may be introduced into the trachea and mucus aspirated through it, if the obstruction seems to be of that nature. The suspension of the child by its feet, and flagellation of back and buttocks serve to allow drainage from the lungs, stimulates the medulla by rush of blood by gravity and by reflex action through the skin, aids in respiration. It should be then plunged into the hot bath at once.

The *Byrd-Dew* method can be used to advantage with the child immersed in the water. This method consists in holding the child upon its back in the palms of the hands, the head supported by one hand. Expiration is produced by bringing the pelvis toward the chest, arching the spine backward and compressing the lungs. Inspiration is produced by raising the ulnar sides of the hands, thus arching the spine forward. At the same time the head is allowed to fall back, thus straightening the trachea and aiding inspiration.

With all the methods of artificial respiration, mouth to mouth *insufflation* is of benefit as it dislodges mucus concealed in the nasopharynx and forcibly dilates the air vesicles. The child's mouth is covered with a piece of gauze, the operator holds the child's nose, slightly compresses the epigastrium, places his lips to the child's and blows air into the child's mouth, after slight compression of the chest to accomplish expiration. This may be repeated once or twice, a fresh piece of gauze being used or a fresh area covering the mouth.

Artificial respiration should not be used oftener than thirty times to the minute.

In *Sylvester's* method the child is placed upon its back, a folded towel under its shoulders, and chin raised. The operator, standing at the head, draws its arms over its head for inspiration, and for expiration carries them down over the chest, at the same time making pressure on the chest wall.

In *Schultze's* method the child is supported with the index fingers in the axilla with its back to the operator. Expiration is produced by raising the child and allowing the feet to fall forward over the face, thus compressing the diaphragm. Inspiration is produced by allowing the child to fall forward into the first position, with the head fully extended, thus straightening the trachea.


Laborde has suggested that rhythmic traction on the tongue, acting through the recurrent laryngeal nerve, may stimulate respiration.

Dilatation of the sphincter ani with the finger is a stimulant to respiration, and should be used in connection with the other methods.

The *pulmotor*, a mechanical device for artificially inducing and maintaining respiration, has been successfully used to establish respiration in asphyxia of the new-born. It is of greater value than the other methods of artificial respiration as it forces oxygen into the lungs.

CARE OF THE NEW-BORN.

Authorities differ as to the proper time to ligate the cord. The child unquestionably has a better start if all of the blood in the placenta can be utilized in its own vessels after birth, hence, ligation of the cord, when the pulsations have ceased, at about 10 inches from the child's abdomen, provided respiration has been prompt, gives the child this advantage. The cord is ligated 2 inches from the abdomen and a second ligature is applied, between which the cord is cut. The ligature material should either be a rubber elastic band, tape or very heavy silk. By using a rubber band which can be applied by means of one of several applicators on the market, continuous pressure is exerted on the vessels as the Wharton's jelly atrophies, and hemorrhage from the cord prevented. If tape or silk is used the cord should be frequently inspected during the first hour or two after birth to guard against hemorrhage. The cord may be dressed with a piece of sterile gauze 3 inches square, cut half across its middle. The cord is drawn through this cut and over it can be poured a dressing composed of balsam of Peru and



castor oil,¹ or a powder composed of one part salicylic acid and three parts of boracic acid. Over the cord is then placed an uncut piece of gauze and all is confined by a flannel binder 6 inches wide, applied snugly but not tightly. This dressing is not removed except it be to renew the oil or the powder until the cord drops off, which usually occurs between the fourth and seventh days. I have seen one cord remain attached for 18 days. If at the end of 10 days the vessels are still attached a ligature should be tied close to the umbilicus and the stump cut away. The umbilicus should be left perfectly smooth and dry after the cord drops off; if moist, a few applications of 2 to 4 per cent solution of nitrate of silver and a drying powder will usually suffice. The flannel binder is only worn for the purposes of preventing an accident to the cord before it separates, and a knit binder is substituted for it at the end of two weeks.

Too frequently a new-born child is neglected by the attending physician. As soon as the cord is cut, it is given to the nurse, and not again looked at. Every child should be carefully inspected by the physician before it is dressed. Its mouth should be examined for presence of cleft palate; extremities for deformities; genitals and anus for abnormalities; scrotum for the presence of the testicles. At the end of six or eight hours, inquiry should be made to learn whether



Fig 5.—Funis Band Applicator (Kelloz).

¹ Balsam of Peru, ℥. 20; castor oil, one ounce.

the bladder and rectum have been evacuated. If the passage of urine seems painful, this may be due to a constricted, pinhole prepuce, or to the passage of uric acid sand with the urine, the latter being present on the napkins and easily seen. If no meconium has been passed the rectum should be inspected for an imperforate anus, and if this is found appropriate measures taken at once for its relief.

The *skin* is covered with a cheesy-like substance called vernix caseosa. This is accumulated to a considerable extent in the flexures and folds of the skin. This substance can be easily removed, if disintegrated by the application of some oily substance. Vaseline, olive oil or unsalted lard is rubbed over the child's body thoroughly, the face being wiped off with a greased piece of gauze. A shirt and napkin are applied and the child wrapped in a blanket and laid upon its right side in either a crib or bassinet. A useful bassinet can be made of a wicker clothes basket which has been padded and a pillow placed in the bottom upon which the child is laid. At the end of four or five hours the child is given its first bath while lying upon the nurse's lap, water at the temperature of 100° F. is used and the vernix removed with a soft cloth without violence. The skin is thoroughly dried and pure talcum used in the folds and flexures of the skin.

Eyes.—Crede's treatment of the eyes for the prevention of ophthalmia neonatorum *should be used in every new-born baby's eyes*. No patient can positively be said to be free from gonococci, and if the treatment is reserved for those cases where there is a history of a purulent vaginal discharge in the mother before delivery, many severe cases will be encountered. The treatment is of itself entirely harmless, and an absolute prophylactic. One or two drops of a 2 per cent solution of nitrate of silver are dropped into each eye, at the outer canthus. Normal salt solution is then squeezed into each eye from a pledget of gauze or medicine dropper, to neutralize any excess of the silver. If any irritation results from this treatment it is very slight and transitory. Other salts of silver have been suggested as a substitute for the nitrate, as argyrol, but none are as effective as the one first suggested by Crede.

Mouth.—As a routine the mouth should be washed with boracic acid solution before and after each nursing, before nursing to protect the mother's nipple, and after, to remove any particles of milk remaining in the folds of mucous membrane. The development of *thrush* or *sprue* is an evidence of carelessness and neglect. A swab of soft sterile gauze or absorbent cotton is made on the end of the little finger and wet with boracic acid solution, and the whole of the inside of the mouth carefully and gently swabbed. Violence should be guarded against as an abrasion of the mucous membrane from too vigorous rubbing may be the site of an infection.

Bathing.—The child should be given a daily bath upon the lap until the cord drops off, the baby being partly covered with the bath blanket. Only pure castile soap should be used in the bath. When the cord has dropped off and the navel is healed, the baby should be soaped while in the lap, then immersed in a baby's bath tub. The tub can be made collapsible, of rubber sheeting, supported on legs of the proper length, so as to make it the correct height to be comfortable and convenient for the mother or nurse. If a small white porcelain tub is used it should be placed on a chair or stool. A folded bath towel should be laid on the bottom of the tub, to prevent the child slipping.

The temperature of the water should be 100° F. After the baby is a month old the water should be cooled to 90° F. before the child is removed. When removed from the water it is wrapped in the bath blanket, carefully dried, the buttocks and flexures powdered, and dressed immediately. The bath should always be given before nursing, never just after being fed. It may be found most convenient and comfortable to the child to give the bath just before the last feeding at bed time. In hot weather a second bath may be given at bed time.

A folded napkin can be placed under the child to soak up any urine which penetrates the first one. *Rubber napkins* should never be used.

Buttocks.—The first discharge from the bowels is meconium. It is composed of epithelial cells and biliary salts, is black and of the consistence of tar. It is difficult to remove from the skin, and when it remains in contact with it for some time irri-

tation and maceration take place, and an intertrigo follows. An intertrigo is always the sign of carelessness. As soon as soiled the napkin should be removed and the skin very gently washed with a soft cloth and water, without soap, and carefully dried and powdered.

Genitals.—The female genitals need but little care except ordinary cleanliness and prompt removal of soiled napkins both day and night. The possibility of the development of a vulvovaginitis, either simple or specific, should be borne in mind. The treatment of the latter is referred to in another place.

Indiscriminate and universal circumcision of a male infant should not be advocated. If, when the baby is a month old, the prepuce is reflected, adhesions broken up and the smegma removed, and vaseline placed well around the corona glandis, the necessity for circumcision is averted. This will prevent the pinhole opening and long prepuce so frequently seen in boy babies in whom this precaution has been omitted. This reflection should be repeated once every second day for a week, then once a week, for the sake of cleanliness. I have seen one case in which an infection occurred after the first reflection at the site of one of the abrasions where a rather tight adhesion had occurred, and considerable pus accumulated behind the corona, this being possible as the mother had failed to again completely reflect the prepuce to cleanse it. The mother should be cautioned in regard to the possibility of a paraphimosis developing from allowing a prepuce to remain reflected behind the corona too long at a time.

No infant should ever be allowed to sleep in the same bed with its mother.

PREPARATION FOR THE BABY.

The baby's basket should be prepared some weeks before birth, and the following articles for it are suggested:

Pin-cushion containing three sizes of safety pins.

Soft hair brush.

Soap box with white castile soap.

Talcum powder in box with perforated top. (*Powder Puff is unhygienic.*)

White vaseline in tube.

Benzoinated oxide of zinc ointment.

Bath thermometer.

Hot-water bag, two-quart, with removable flannellette bag with draw string.

Saturated solution of boracic acid.

One pair blunt scissors.

Absorbent cotton, wrapped in small towel.

Soft towels made of old damask.

Apron bath blanket of outing flannel made of two thicknesses sewed together at the top only.

Wooden tooth picks to be wrapped with absorbent cotton at one end to be used as swab for cleaning nose.

Two or three thin flannel bands, six inches wide.

Soft linen of double thickness, or cheese cloth for wash cloths.

Squares of sterile gauze for washing mouth.

Medicine dropper.

A box or special drawer should be provided for the baby's clothes. The outfit should consist of the following:

Four dozen napkins made of cotton birdseye, two sizes, 20 inches and 24 inches wide. Either square or double.

Six flannel skirts.

Four silk and wool shirts.

Four knit bands.

Four outing flannel gowns.

Nine white slips, nainsook or longcloth.

Three white cambric petticoats. (To be worn only in summer, and not with flannel ones.)

Two white baby blankets or comforts.

Two knitted sacks.

Two or three quilted pads for baby's bed, one yard square.

One cloak—two caps—one veil.

Two pieces rubber cloth, one yard square.

Fine hair pillow, 10 x 12 in. for buggy.

Six pillow slips.

Six sheets for bassinet.

Skirt stretcher.

Stocking stretcher. For drying these garments without shrinking them.

One flannel bag for tying about child's waist when out of doors.

Much help can be had in making the baby's clothes by using Butterick's fashions, set No. 7080.

CARE OF NAPKINS.

Too great emphasis cannot be laid on the importance of careful washing of the napkins, both when soiled with a movement from the bowels and when wet with urine only. They should be washed with soap and soda, followed by several rinsings in cold water, and dried out of the nursery, folded smooth by hand and not ironed, as ironing renders them less absorbent. I have seen several cases of severe eczema, limited to the part of the body covered by the napkin, where inquiry developed the fact that the napkin was being used after being wet three or four successive times and simply dried without washing.

As soon as a napkin is soiled it should be taken to the bath room or closet and the movement scraped off with a knife kept for that purpose, wiping the scrapings on a piece of toilet paper and throwing it in the closet. The diaper is then put in a covered porcelain bucket, which should be provided, containing a weak formaldehyde solution or a 1 to 100 carbolic acid solution in which the soiled napkins can be placed until washed.

THE NURSERY.

The nursery should be a bright cheery room, with an open fireplace for winter heating, if possible. The temperature should not be over 70° F., and the air should be changed at least once daily, first removing the child and opening all windows for a half to one hour. It should have not less than 1000 cubic feet of air space, and more if possible. Emphasis should be laid upon the importance of a moist air in steam-heated or hot-air-heated houses.

The walls should by preference be painted and the floor uncarpeted, either hardwood or painted. This makes it possible for the floor to be wiped up and not swept, thus avoiding dust. The use of a compressed air-cleaning device in private houses should be recommended, where there are children, especially. There should be plenty of light, when the child is awake, with dark shades to darken the room when asleep, and the room should be at least 5° cooler at this time. In favorable weather the child can sleep in its buggy out of doors, protected from the wind and its eyes from the light.

The skin of the new-born is very delicate, and is covered with *lanugo*, a fine downy hair, which is soon rubbed off. There is frequently desquamation of the skin, either general or on various parts of the body.

Most infants have a rather heavy suit of *hair*, at birth, and during the first three months this is usually rubbed off, first on the back of the head, where it comes in contact with the bed, and this is replaced by a finer and softer growth.

In the new-born the *temperature* is usually elevated 1° or 2° F. A large number of observations made by Edwards, Keating and Holt, have demonstrated that the temperature in infants, between ages of one and twelve months, ranges between 99° F. and 99.5° F., and that only a temperature of 100° F. or over should be considered as abnormal. A continuous subnormal temperature is one of the best indications of poor nourishment.

If no deformity exists, an infant should pass *urine* during the first two or three hours after birth. The first secretion is usually clear, but it may become turbid, or contain a deposit sufficiently thick to stain the napkin, or distinct particles of uric acid sand may be passed. Some pain is usually experienced when the latter is passing. The urine later in infancy is very light in color and of low specific gravity.

CHAPTER III.

DISEASES AND INJURIES OF THE NEW-BORN.

Caput Succedaneum.—This is a collection of blood serum in the cellular tissue of the presenting part of the child. It is due to a constriction of the veins of the skin by the bony pelvis preventing a free return of the blood and allowing an escape of the serum into the cellular tissue. It is present at birth, and in vertex presentations, the scalp may be thick enough to make it impossible to detect any of the sutures or fontanelles. The extravasation has usually been absorbed by the end of the second day, and the scalp and head have a normal appearance.

Cephalhematoma.—This is an extravasion of blood from a ruptured capillary between the periosteum and the bone. It usually does not occur until the third or fourth day, and is most frequently found over one or both parietal bones. The extravasation of blood is limited entirely to the bone over which it occurs, as the periosteum is bound down to the edges of the bone. If over both parietals, there is a deep sulcus between, corresponding to the sagittal suture, and looking at the head from behind it has the appearance of two half oranges under the skin on opposite sides.

Cephalhematoma must be differentiated from *hernia cerebri*. In the latter the tumor is a pulsating one and in cephalhematoma it is not. Crying will increase the tension of a hernia but causes no change in the cephalhematoma. Cephalhematoma is not always due to injuries sustained in prolonged, natural or instrumental deliveries, in vertex presentations. As an instance may be mentioned two cases under my observation, both in breech presentation. One was a double cephalhematoma, the other triple, hemorrhage occurring over both parietal and the occipital bones.

In rare instances suppuration ensues, in which event all the

signs of an abscess will be present, and surgical intervention is called for at once.

Treatment.—The temptation is to interfere in cases of cephalhematoma, but under no circumstances should they be interfered with. If protected from injury from pressure, nature takes care of the effused blood by absorption, and in the majority of cases after being absorbed, no trace of them can be found, unless it be a small ridge at the extreme edges of the tumor. Incision may be practiced under the strictest aseptic precautions, but the difficulty of maintaining pressure upon the head to prevent the further effusion of blood after evacuation of the clot must be borne in mind.

Umbilical Hemorrhage.—Hemorrhage from the cord may occur before it drops off, either from a loosely applied ligature or from the vessels being cut through by a small ligature being tied too tightly. Both of these accidents can be prevented by the use of a rubber elastic ligature, in the form of a small rubber ring of caliber smaller than the circumference of the cord, which is stretched and slipped over the severed end of the cord, by one of the appliances for that purpose. A ligature of this kind exerts continuous pressure on the vessels as the Wharton's jelly dries, and bleeding is more effectually prevented than can possibly be done by any other means.

Hemorrhage may occur from the umbilicus after the cord has dropped off, during the second or third week, and in all such cases there is a tendency to hemorrhage as is found in hemophilia or the "bleeders."

Pressure upon the bleeding vessels at this point is very difficult to accomplish. If there is but a small amount of oozing, the application of persulphate of iron or a one to one thousand solution of adrenalin may control it. Needles carried under the umbilicus at right angles, and wrapped with a figure of eight suture should be tried in the severer cases.

Granulating Umbilicus.—After the separation of the cord, one or more of the vessels may be left as a small granular spot, from which there is a serous, or seropurulent discharge, an eczema of the skin of the umbilicus sometimes following.

Treatment.—A cure may be had by the application of a solu-

tion of nitrate of silver, 30 to 40 grains to the ounce, followed by a dry, absorbent dressing, as powdered boracic acid and starch, equal parts, this being repeated once daily.

In the event that there is a protrusion of the stump of the vessels, after the cord drops off, a silk ligature should be thrown



Fig 6.—Umbilical granulation removed by ligature six weeks after birth.

around its base and tied tightly. When this stump separates it will promptly heal under a dry dressing.

Hemorrhage.—New-born babies are specially prone to develop hemorrhages, and because of the indefinite knowledge to-day of the true pathology of the condition, the symptom complex is now called in general terms, "hemorrhage of the new-born." Formerly an attempt was made to describe each case according to the location of the hemorrhage, in this way having a number

of terms, descriptive of the same general underlying disease. Kling, Genrich and Runge, quoted by Koplik, state that hemorrhagic disease in the new-born occurs about once in 1000 cases.

Etiology.—The etiology of the condition is obscure; but in view of the fact that fever is a prominent symptom in most cases, the consensus of opinion is that the most frequent causative factor is a general septic infection. The new-born develops sepsis easily and the entrance to the system of the offending organisms may be at many points, the gastrointestinal tract, the mouth, the genitourinary tract and the umbilicus being the most frequent portals. Gartner claims to have found bacilli in the feces in cases of melena, proving his theory that this form of hemorrhages is a coccal sepsis. In Winckel's disease, a condition closely similar, a bacteremia is present, streptococci and bacilli having been found in various organs and the blood. The changes which occur in syphilis, which has been named as a cause, are in the blood vessels rather than in the blood itself.

Among the other causative factors have been mentioned prematurity, atelectasis, deformity of the heart, persistent foramen ovale or ductus arteriosus, ulcer of the stomach and intestine, the latter due to a venous stasis, followed by a thrombosis; fatty degeneration of the arterioles; extreme delicacy of the blood vessels; congenital obstruction of the portal venous system; congestion from pulmonary, cardiac or hepatic disease; excessive secretion of gastric juice resulting in partial digestion of the mucosa of stomach and intestine, congenital hemophilia and the great changes taking place in the circulation incident to birth.

Hemorrhages in the new-born may take place from any organ and the hemorrhage may occur before birth or subsequently. When postnatal, it usually occurs within the first three days after birth.

In Dr. Townsend's 50 cases, quoted by Rotch, he gives the following location of the hemorrhages:

Intestines	20	Ecchymoses in Skin.....	21
Stomach	14	Scratch of Skin.....	1
Nose	12	Cephalhematoma	3
Mouth	14	Meninges	4
Umbilicus	16	Abdominal Cavity	2

Pleural Cavity	2	chymosis of skin	3
Lung	1	Gastro-enteric tract alone	19
Thymus Gland	1	From umbilicus alone	3
From Gastro-enteric tract, nose, umbilicus accompanied by ec-		Ecchymoses of skin alone.....	6

Holt gives Ritter's statistics in 190 cases as follows: Hemorrhage from the umbilicus, 138 (umbilicus alone, 97); intestines, 39; mouth, 28; stomach, 20; conjunctivæ, 20; ears, 9.

I have seen one case of hemorrhage into the suprarenal gland, a number of cases of cephalhematoma, both single and double, and the case shortly to be reported, of melena, or hemorrhage from the stomach and intestine. In the case of hemorrhage in the suprarenal capsule, reported in full in the *Archives of Pediatrics*, November, 1892, the right suprarenal gland was distended with blood to the size of an orange, and blood clots were found behind the kidney and in the free peritoneal cavity. The diagnosis was not made in this case during life, the most prominent symptom being a profound jaundice. The hemorrhage was found postmortem.

Hemorrhage from the gastrointestinal tract may occur independently of bleeding from any other organ and is called melenæ. If from the mouth alone, the quantity of blood lost is usually small, if from the stomach large quantities may be vomited or passed from the bowel in form of clots. As stated, it has been thought by different observers to be due to an ulceration of the mucous membrane, following septic emboli of its vessels, a digestion of the membrane by a hyperacid gastric juice, or to a general pyogenic septic condition. Like the other forms it usually occurs during the first three days, and with great variety as late as the ninth day. The child may first vomit some red blood, followed soon afterward by a coffee-ground vomit, or blood may first be noticed in the discharges from the bowel. The meconium, being very dark in color, may cause blood in the actions to be overlooked, unless it is passed in large clots. If passed in considerable quantity the napkin at the edge of the mass will be stained a reddish color, or if blood is suspected a microscopic examination will reveal the blood corpuscles. It should be borne in mind, before a diagnosis of hemorrhagic dis-

ease is made, that the source of blood may have been a fissured nipple, or blood from the nose which has been swallowed. I have seen one case which caused considerable uneasiness until it was finally decided that the source of the blood was from a cracked nipple.

Prognosis.—The prognosis in hemorrhagic diseases of the new-born varies according to the site of the bleeding. Taken as a whole the mortality is given by various authors differently: Townsend's cases 62 per cent, and in another series of 709, 79 per cent; Williams places it at 60 per cent; Holt states that no observer has seen more than one-third of his cases recover.

The following history is given as illustrative of that form of hemorrhage known as melena:

Child of III Gravid. First labor instrumental, occiput posterior, forceps rotation. Second labor normal, but prolonged. Third labor began at 12 midnight, birth at 1 p. m. following day. Vertex presentation; first position; mechanism and labor normal. Child, female; weight, 9 pounds 8 ounces; normal in every way; primary respiration prompt and normal; no cyanosis; nursed vigorously when put to the breast. An abundant supply of milk appearing on the third day. On the third day at noon the child vomited red blood, sufficient in quantity to stain its clothes through and through. Shortly after this a very large amount of meconium was passed containing red blood, very easily distinguished in the black meconium mass. Child pale and blue around the nose, pulse weak and rapid; refused to nurse after vomiting blood, the nursing being discontinued after hemorrhage was reported.

For five days vomiting of blood and hemorrhage from the bowels occurred, the latter quite profuse and being passed in masses of clots.

After treatment with subcutaneous injection of gelatin solution, 2 per cent, described below, the child made a good recovery: at the end of the second week it had regained its birth weight and continued to thrive.

Treatment.—Various methods of treatment have been suggested by different authors. Koplik suggests the cold coil; ergotin, one-half to three-fourths grain subcutaneously: Henoch suggests one drop of liquor ferri sesquichloridi in barley water every hour; Williams suggests gallic acid, gr. i, every three hours; oil of turpentine, m. i, in mucilage every hour; extract of krameria gr. ii, every two or three hours, or an injection into the bowel of an infusion 4 to 5 ounces, and calcium chloride to increase the coagulability of the blood.

The subcutaneous injection of gelatin employed in the case reported was followed by very prompt recovery.

The English gelatin is used, as the ordinary commercial gelatin has been found contaminated with the tetanus bacillus. Two sterilizations are made in order to be sure this organism is destroyed. An ordinary antitoxin syringe or aspirator, without too large a needle can be used for the injection. The cellular tissue of the back can be used, the solution warmed, and 20 cc. can be slowly injected.

P. Emile Weil¹ while studying hemophilia began the use of fresh animal sera injected either intravenously or subcutaneously as a means of controlling or preventing hemorrhage. These observations brought out the fact that the serum from horses, rabbits, men and cattle had the power of controlling hemorrhage by increasing the coagulability of the blood; that the serum from beef possessed too much toxicity; that the serum should be less than two weeks old; that the dose was 15 to 30 cc.; it is of service locally in causing clotting; that the increased coagulability persisted for a period of from 15 days to several weeks; that sporadic hemophilia and acute purpura gave the most definite cures.

As long as there is any bleeding from the stomach food cannot be given in this way, but it can be given by nutrient enemata.

A case has been very recently under my observation in which the hemorrhage was from the bowel alone. On the fourth day a very large bloody movement was passed, followed in twenty-four hours by six smaller ones. The child showed decided depression, pallor, listlessness and crying at intervals, sweating and nursed poorly. It had been given two minims of 1:1000 adrenalin solution without effect, and on the second morning shortly after a stool containing bright red blood, it was given 7½ cc. of normal blood serum in the thigh hypodermatically, after which no further bleeding occurred.

UMBILICAL HERNIA.

Etiology.—The failure of the umbilical ring to firmly unite after the cord drops off is the chief cause. Contributory cause is the continuous crying of babies subject to colic, hunger, etc., or

¹ Leary: Boston Medical and Surgical Journal, vol. clix, No. 3.

who strain from constipation. The tumor varies in size from a small knuckle to a large protuberance.

Contents.—The contents of the sac may be omentum alone or gut, with or without omentum.

Treatment.—This is either surgical or palliative. Cures can be obtained by the use of an adhesive strip 2 inches wide, and long



Fig 7.—Adhesive strap for umbilical hernia

enough to reach to the anterior axillary line on each side. The hernia is reduced, a pad is made of a button mold, covered with adhesive plaster, or of several thicknesses of plaster, and placed over the ring. One end of the plaster is applied and drawn over the umbilicus, the pad in place, and the skin over the umbilicus drawn up into small folds. When the adhesive is changed, which should be done every week or ten days, or as often as loosened, the finger is placed beneath the pad and held until the new strip is applied.

Should the hernia become irreducible, resort should be had to surgery at once.

ATELECTASIS.

Definition.—This is a condition of the lungs in which all of a lobe or a portion of one remains collapsed after birth, the lung remaining as in the fetal state.

Etiology.—The condition usually follows an attack of asphyxia neonatorum. If the primary wiping out of the mouth and nose is not done, mucus may be aspirated and mechanically plug up one of the bronchial tubes, permanently closing it, allowing all lung tissue supplied by it to remain collapsed. Prematurity is a contributing cause.

Pathology.—The surface of the lung subject of atelectasis shows depressions, corresponding to the undilated portion, with air in surrounding tissue. These areas do not crepitate on pressure and if part of the affected portion is excised it will sink in water. Much-dilated bronchioles, areas of compensatory emphysema, surround the collapsed portion.

Symptoms.—Practically the only diagnostic sign of importance is the presence of cyanosis with no heart lesion being found. The child does not thrive, is bluish in color, especially when crying, and the cry is feeble. Convulsions may rarely be seen. The *physical signs* are of little assistance in reaching a diagnosis. Owing to the emphysematous areas around the atelectasis, no dulness or bronchial breathing can be obtained. The respiratory murmur is feeble and slightly harsher than normal.

Treatment.—The principal treatment is that of prevention, by attempting to cause the child to take deep inspirations immediately after birth. The methods of artificial respiration mentioned elsewhere should be employed early.

ICTERUS.

Jaundice is present in from one-third to one-half of all newborn infants. The depth of the discoloration may be a very slight yellow tinge of the skin and conjunctiva, usually classified as the (a) Mild Form, and a deep injection of these tissues the (b) Grave Form.

Etiology.—Many causes have been suggested. Sepsis causing a fatty degeneration of the liver has been named as one of the principal causes. Changes in the circulation accident to birth has also been named. The cause may be mechanical, as a tumor, as in the case of suprarenal hemorrhage (page 40), pressing on the gall bladder and ducts. The condition may be hematogenous in character.

Symptoms.—In the *mild* form there may be a slight discoloration of the conjunctiva and of the skin of the face, chest and back, or there may be a deep injection of the skin of the entire body, discoloration of the urine and light colored movements. These changes usually appear by the end of the first week and persist for a week or ten days, with a gradual return to normal conditions. The child may be slightly apathetic, nurse poorly and sleep more than usual during this time, with a gradual return to normal in one or two weeks.

In the *grave* form there may be a congenital malformation of bile ducts or gall-bladder, with cirrhotic changes in the liver. The symptoms are the same as in the mild form save they are all intensified; umbilical and other hemorrhages are more often seen, and death ensues promptly.

Treatment.—Saline enemata once or twice daily is of great benefit. The ordinary cases usually require no treatment except a dose of calomel or castor oil.

SEPSIS.

Etiology.—This condition is due to an infection of the newborn by one or more of the pus-producing organisms, the streptococcus or the staphylococcus being the most frequent form. The most favorable site for entrance of the organism is the umbilicus, either before or after the separation of the stump. The infecting organism may be carried to this point by the capillary action of an infected napkin; hence the necessity for an antiseptic dressing to the umbilicus until the navel has healed.

The following portals of entry of the organism may be mentioned: *Injuries* and *abrasions*, as in a forceps operation, with an infection after birth; abrasion of the *mucous membrane of the mouth*; *septicemia* of the mother during the later weeks

of pregnancy; *putrefaction* of the *liquor amnii*, with ingestion or aspiration of this by the child before and during labor; or a violent *vaginitis* and *endocervicitis* of the mother before birth and infection of child in its progress through the canal; *suppuration* of the *mammary gland* during lactation, and an infection of a milk duct, with a contamination of the milk, the infection being through the gastrointestinal tract; or an infected wound following clipping of the *frenum linguae* in tongue tie or following circumcision.

Systemic Symptoms.—The first evidence of the condition usually appears during the first week and may be a failure of the child to nurse. If the infection has been at the navel and there is peritoneal involvement, or an inflammation of the vessels under the anterior abdominal wall, there is *continuous crying*, distension of the abdomen and the child lies with legs drawn up. The *temperature* is high but fluctuating; *jaundice* is present when the liver is involved; *pulse* rapid and small; *skin* hot and dry, and there may be petechial spots develop or large ecchymotic areas, frequently they appear on the part which is in contact with pillow and bed.

Prognosis is very grave.

Treatment.—Support and nourishment offer the only possible hope of relief. If the child is unable to nurse, rectal feeding and gavage must be resorted to, using by the former completely peptonized milk, and by gavage, breast milk, if it can be obtained.

CASE I. Baby D, born of primiparous mother, after a tedious labor, terminated by instrumental delivery, which was easy. No abrasions or abnormality noticed. Mother developed sepsis during the first week, with temperature to 106° F., on one occasion. Local focus of infection found in posterior vaginal culdesac which had sustained a rent in the mucous membrane during the delivery. Cephalhematoma over left parietal developed on third day; fever began evening of third day, continuous and high, often to 104° F.; hemorrhage from frenum, which was clipped at this time; both ears discharging on tenth day; losing weight steadily, gavage; catarrhal enteritis; convulsions on fourteenth day; jaundice on twentieth day; ecchymoses general, and rigidity of extremities and spine; death on twenty-first day.

CASE II. Tedious labor, terminated by forceps delivery, child weigh-

ing 7½ pounds; normal for first three days; temperature of 104° F. on morning of fourth day, which was thought to be due to starvation. Artificial feeding reduced temperature to 100.6° F., and it was normal the next day. The cord dropped off on the fifth day, leaving a moist base. On the seventh day the temperature was 104.4° F.; listless and slow about nursing. Pus found in umbilical depression; pain on manipulation of abdominal wall, and some distension. Continuous temperature until its death, three days later, when it reached 107° F. Just before its death hands and feet became cold and blue, changing to deep purple, the discoloration on the lower extremities extending to the hips.

INJURIES TO THE NEW-BORN.

As a result of prolonged labor, pelvic deformities, with instrumental or manual delivery to overcome these conditions, the child may sustain fatal injuries, or injuries which may cripple it for life.

High Forceps is a capital operation with very serious results in a large percentage of cases. Williams, in 119 collected cases of high forceps, found a maternal mortality of 40 per cent and an infantile mortality of 60 per cent.

As a result of *forceps operation* the following injuries may be named: Lacerations of the skin by the blades; injury to eye, especially when a fenestrated blade is applied too far up upon the head; facial paralysis; depressed cranial bone, or a fracture of the bones; cerebral hemorrhage from rupture of vessels in the meninges or brain; facial paralysis from pressure of the tips of the blades on the seventh nerve.

Version.—May result seriously to a living child. Among the most frequent accidents are fractures of the long bones of the extremities and the clavicle; laceration or rupture or hematoma of the sternocleidomastoid muscle; fracture and depression of the cranial bones; rupture of vessels in the meninges or of the sinues in the dura; Erb's paralysis from pressure on the brachial plexus of nerves; atelectasis from delayed delivery of the after-coming head.

MASTITIS.

During the first two weeks after birth the child's breasts frequently become distended with milk, occurring in either sex. The breasts may become tense and painful to the touch, causing

restlessness and crying. If friction or pressure is used upon them, a breaking down of the gland tissue is apt to ensue, or an infection follow which results in a severe inflammation, with formation of pus.

Focal Symptoms.—Continued enlargement of the breast, redness of the skin over it, fluctuation, tenderness on manipulation.

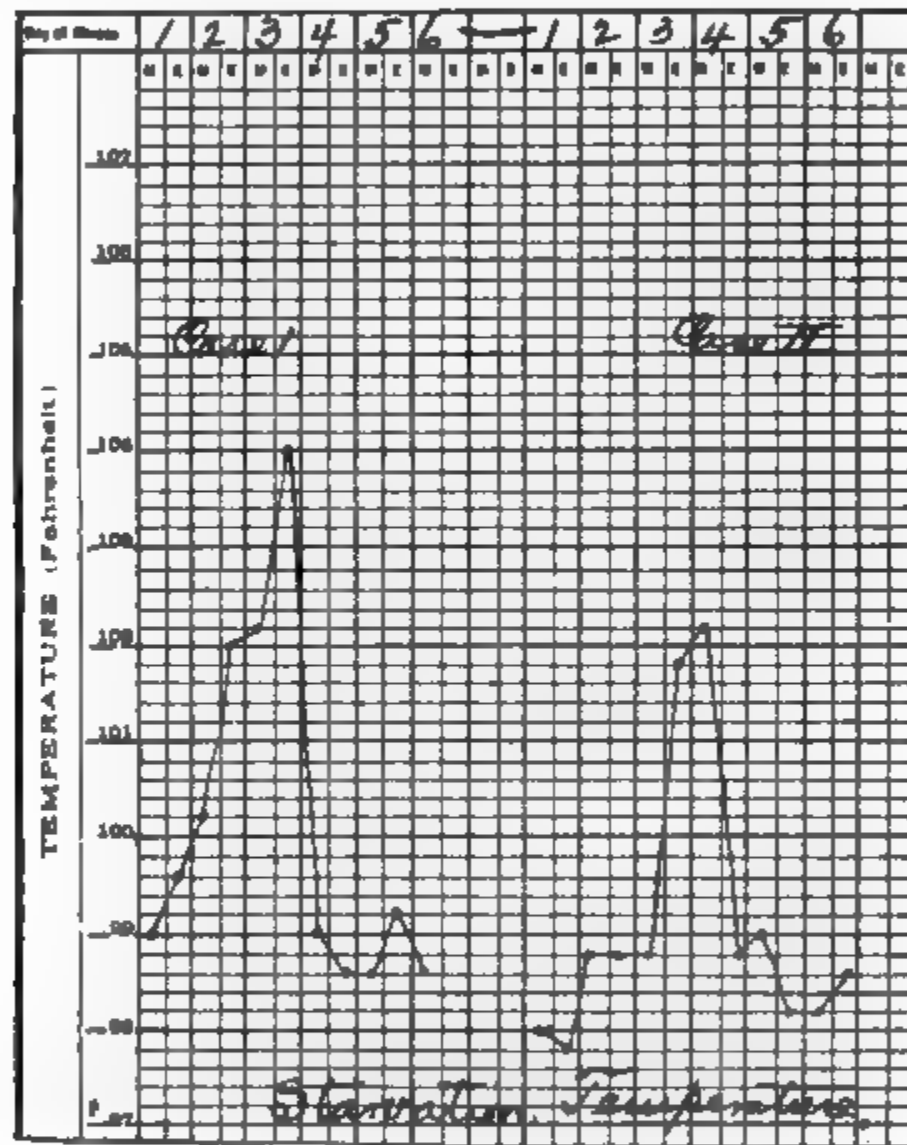


Fig. 8—Stimulation temperature

Prognosis.—If an abscess does not result, the milk is soon absorbed and no trouble results, but if an abscess forms, and an incision is necessitated, the function of the gland of a female may be impaired in later life.

Under aseptic precautions, in suspected cases, a hypodermic needle may be inserted and the contents aspirated to learn the presence or absence of pus.

STARVATION TEMPERATURE.

The accompanying charts indicate the condition which is frequently seen during the first few days after birth, the second or the third, as a rule, in which there is a rise in temperature, which subsides after the administration of an artificial feeding, or which will disappear as soon as the milk appears in the mother's breast. It is a phenomenon too infrequently noticed, as the temperature of but few new-born babies is taken.

Symptoms.—An apparently perfectly healthy and sound baby cries, sucks its fists and tugs at the empty breasts, and is very restless; its skin, mouth and tongue are hot and dry; and prostration begins promptly. The temperature rises quickly and has usually reached its maximum in a few hours.

Treatment.—In the presence of a high fever without other definite symptoms the child should be given an artificial feeding, if the breasts are not secreting, composed of a weak modified milk mixture of a formula approximating the following: Fat, 1., sugar 6., proteid 0.50, $\frac{1}{2}$ to 1 ounce at a feeding. The temperature should be taken again in a few hours to ascertain its course, and if it is declining the baby should be fed regularly until the milk comes. If it will not nurse, gavage may be tried with excellent results.

CEREBRAL HEMORRHAGE.

The proneness of new-born infants to hemorrhages, has already been referred to. Cerebral hemorrhages may arise from the vessels in the brain, meninges or dura, may be very small in size or consist of large extravasations. They frequently follow a tedious or instrumental delivery and deformed pelvis which cause undue intracranial pressure. This complication will be referred to in another chapter.

TETANUS.

Synonyms.—*Lockjaw*, *trismus nascentium*.

Etiology.—Tetanus is due to the entrance of the tetanus bacillus into the circulation, its toxins exerting their effect particularly upon the central nervous system. The bacillus may enter at the umbilicus or an abrasion of the skin carried through

the medium of unclean hands, dressings, etc. The principal habitat of the bacillus is in the neighborhood of stables and stable yards, and dust and dirt from this locality may convey the infection.

Pathology.—There may not be any characteristic change in the tissues at the point of entrance of the bacillus, or a slight inflammatory reaction. The brain and cord may show punctate hemorrhages or larger extravasations, as a result of the convulsions. The internal organs are congested and there are serious exudates in the ventricles and cord.

Symptoms.—In a majority of cases the symptoms appear during the first week or ten days after birth, though they may occur any time before the fourteenth day. It is rare during the third week.

The child may at first be listless and show a disinclination to nurse; there soon follows a spasmodic contraction of the muscles of the lower jaw, which very soon becomes fixed and tightly closed. It is impossible to push the nipple between the child's gums. If liquids are poured into the mouth swallowing is impossible, and the first few drops passing the pharynx may cause a reflex spasm of the pharyngeal muscles and a general convulsion. The child has an anxious, frowning look, between the spasms, and a more or less general spasmodic contraction of the facial muscles during a convulsion. During a general convulsion the respirations are stertorous and between, they are hurried and superficial. The sphincters of bladder and rectum are relaxed and involuntary passages are usual. As the case progresses the periods of rest between the convulsions are shorter, contractions begin, the spine becomes contracted, arching backward, the opisthotonos being at times extreme, the child resting on head and heels. The temperature is usually very high, 104° F. to 106° F. In the latter period a convulsion may be induced by touching the child, especially about the face. Feeding is impossible.

Prognosis is very grave, as nearly all cases die. The younger the child the more hopeless the case. Escherich reports recoveries.

Diagnosis.—This is usually easy and must be made from

meningitis and from the paralyses and contractions following cerebral hemorrhages of the new-born.

Treatment.—The most favorable results can be had from the use of the tetanus antitoxin, which, like the diphtheria antitoxin, gives the best results the earlier it is used. As in adults the serum is a better prophylactic agent than a curative one. Five to ten cubic centimetres of the antitoxin may be injected, and repeated in from six to eight hours. The subcutaneous method is recommended, over the injection into the spinal canal, owing to the difficulty of performing the latter operation. The influence upon the minds of the family of the lumbar puncture is very great, and a fatal result of the disease is attributed to the puncture by the average layman.

Prophylaxis is the chief treatment, strict cleanliness in tying the cord and its care afterward being an absolute essential. Upon the appearance of the symptoms, control the convulsions if they are severe, by inhalations of chloroform. Give at once the following prescription by rectum, using the small bulb syringe:

℞ Strontii bromidi gr. v
Chloralis hydratis gr. ii
Aquæ distillat ʒi
M ft. Clyster.

This may be repeated in two or three hours for its effect. Gavage should be resorted to with tube introduced through the nose in those cases in which improvement is noted in the convulsive stage.

SCLEREMA.

Etiology.—This is obscure, being ascribed as due to sepsis, persistent fetal circulation; athrepsia, especially that following acute diarrheal diseases and poor nourishment. Two forms are described, *scleredema* or the edematous form, and *sclerema adiposum* or fat sclerema.

Pathology.—In *scleredema* the changes described are an edematous deposit in the skin, cellular tissue, muscles; serum in the peritoneal and pleural cavities; inflammatory conditions of the intestines and lungs; atelectasis; fatty liver and spleen.

In the form known as *sclerema adiposum*, there is a hardening of the tissues, a drying up of the fat in them, the changes in the internal organs being much the same as in the other form.

Symptoms.—In scleredema there is a subnormal temperature, with dry, cold skin. The parts first affected are usually the calves of the legs, the thighs, abdominal wall and if severe, then the rest of the body. The skin may pit on pressure, or in the more severe forms be so tense as not to be influenced by pressure. If punctured yellowish serum, rather oily, exudes.

In favorable cases the skin gradually resumes the normal, leaving wrinkles over the previously affected parts. Desquamation usually supervenes.

In *sclerema adiposum* the legs are also the first part affected, usually symmetrically. It also may involve the whole body, except, as a rule, the palmar surfaces of the hands and plantar surfaces of the feet. The skin feels doughy, it is closely adherent to the underlying tissues. The heart is weak and much slower than normal, as are the respirations. The temperature is usually lower in this form, 92° F. being recorded as having been reached.

Duration is short in both forms, though it is usually much more rapidly fatal in the latter form.

Prognosis is very grave in both forms, though recovery is reported in both.

Treatment.—The first indication is the restoration and maintenance of the body temperature, which can be done by improvising an incubator. External heat is most important. Stimulants are necessary, especially whisky and strychnia, 1/200 grain of the latter, by the mouth or subcutaneously in a portion of the body unaffected. Camphor in olive oil may be given by hypodermic in very weak heart action with good results.

External application of cod liver or olive oil, with mild massage, is a great help. Gavage may have to be resorted to in some cases.

CHAPTER IV.

GROWTH AND DEVELOPMENT.

The average weight for boy babies at birth is about $7\frac{1}{2}$ pounds, of girls 7 pounds. But few babies weigh as much as 12

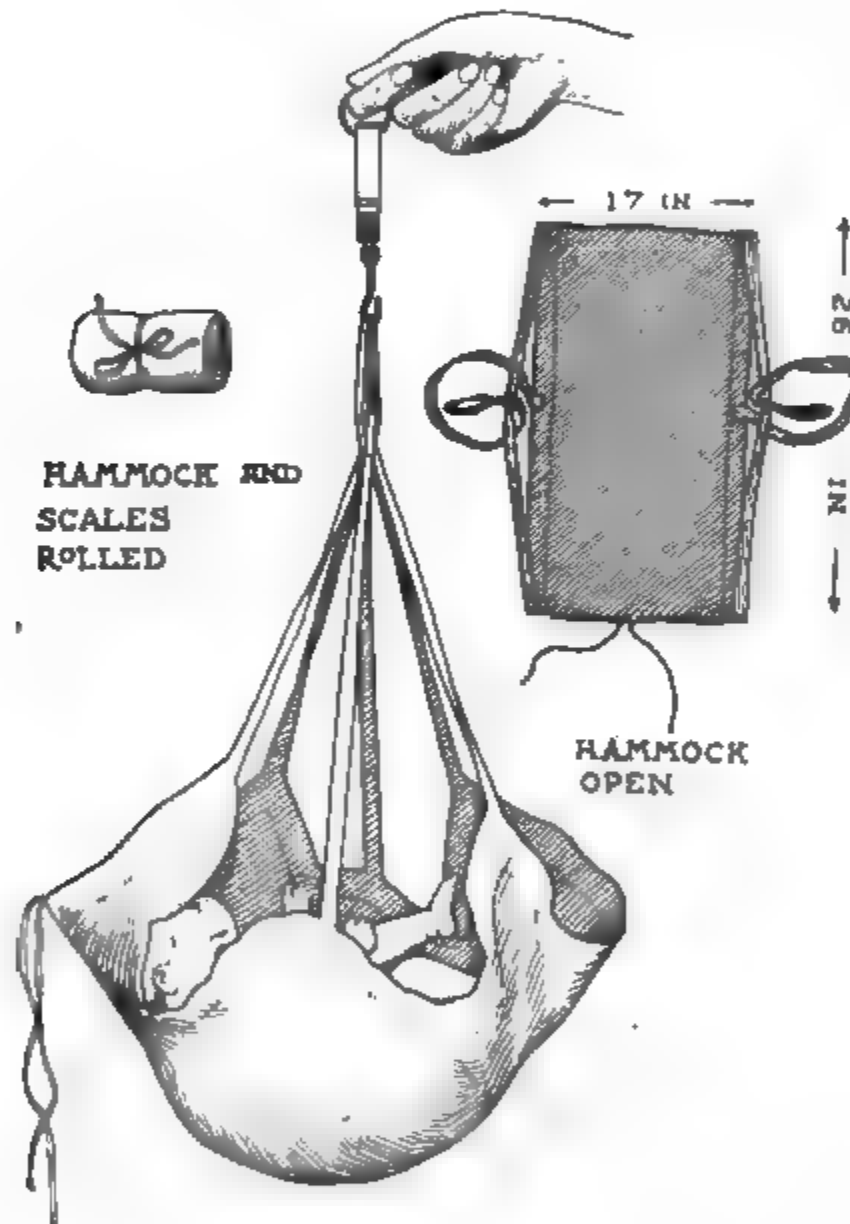


Fig. 9.—Hammock scale (Cooke).

pounds at birth. During the first week after birth the child loses in weight, frequently as much as a pound, but upon the advent of the mother's milk the gain in weight is steady and

should be not less than 4 ounces a week. Usually at the end of the third week it has more than regained its birthweight. No other single method is of such assistance in determining a child's progress as its weight, and a pair of scales should be as much a part of a nursery outfit as a baby's bed. The platform dial scale upon which has been anchored a basket is a very useful one, as it weighs in one-quarter pounds, but the platform, arm-balance scale is much more accurate. The weighing is best done after a bath when the child has been dried ready for dressing. It is thus weighed without clothes and with an empty



Fig 10 - Nursery scales.

stomach. If the dial scale is used the arrow can be made to start at zero by the set-screw on the top after the blanket has been placed in the basket; but if the balance scale is used the blanket must be accurately weighed and deducted from the gross weight.

As a rule infants which are deprived of normal breast milk do not thrive as rapidly as those who are nursed at the breast. When a suitable formula of modified milk has been provided the gain is then satisfactory.

While it is of great service to the physician in estimating the progress of a child, to know its weight from week to week, this regular weekly weighing may unnecessarily worry a nervous mother, and some discretion must be exercised in requesting it.

The following chart, an average taken from a number of pub-

lished records of investigations, gives the growth of the infant from birth through childhood.

		WEIGHT.	HEIGHT.	HEAD CIRCUM.	CHEST BREADTH
Birth	Boys.....	7.47	20.1	13.8	13.0
	Girls.....	7.13	19.9	13.3	12.4
6 mos.	Boys.....	16.0	25.4	16.5	16.6
	Girls.....	15.5	25.0	16.5	15.6
12 mos.	Boys.....	21.2	29.2	17.9	17.9
	Girls.....	20.4	28.7	17.9	18.2
18 mos.	Boys.....	22.8	30.0	18.5	18.5
	Girls.....	22.0	29.7	18.0	18.2
2 yrs.	Boys.....	28.4	33.1	19.1	19.5
	Girls.....	27.8	32.7	18.3	18.2
3 yrs.	Boys.....	33.5	36.0	19.3	20.1
	Girls.....	31.5	35.6	19.0	19.8
4 yrs.	Boys.....	36.4	38.6	19.7	20.7
	Girls.....	35.1	38.4	19.5	20.5
5 yrs.	Boys.....	41.4	41.7	20.3	21.5
	Girls.....	40.2	41.3	19.9	21.2
6 yrs.	Boys.....	45.1	44.0	20.0	23.2
	Girls.....	43.6	43.4	19.8	22.8
7 yrs.	Boys.....	49.5	46.1	20.0	23.7
	Girls.....	47.8	45.8	20.0	23.3
8 yrs.	Boys.....	54.5	48.5	20.5	24.4
	Girls.....	52.2	47.8	20.2	23.8
9 yrs.	Boys.....	59.8	50.0	20.6	25.1
	Girls.....	57.4	49.6	21.2	24.5
10 yrs.	Boys.....	66.0	52.0	20.6	25.8
	Girls.....	63.0	51.7	20.5	24.7
11 yrs.	Boys.....	71.5	53.8	20.8	27.2
	Girls.....	69.9	53.8	20.7	25.8
12 yrs.	Boys.....	78.8	55.6	21.0	27.5
	Girls.....	80.0	56.6	20.9	26.8
13 yrs.	Boys.....	86.0	57.8	21.1	27.7
	Girls.....	89.9	58.6	21.5	28.5
14 yrs.	Boys.....	97.2	60.5	21.3	28.8
	Girls.....	99.3	60.3	21.3	30.0
15 yrs.	Boys.....	104.1	62.9	22.2	30.5
	Girls.....	107.5	61.5	22.0	31.0

The suggestion of Holt that a record blank or "progress report" be printed and given to mothers when dismissed from their puerperium, which are to be filled out and mailed to the

physician at weekly or bi-weekly intervals, is a most excellent one. The following chart, a modification of Holt's, is of great service in recording the progress of the child; its weight, gain or loss; digestion, disposition, food prescriptions, etc. In the card index system it is easily referred to, and a matter of permanent record. The last three lines are filled in by the physician recording any changes which may be made in food prescriptions, if laboratory fed, and the formula if the milk is modified at home.

REPORT ON PROGRESS OF

Name Date..... 19...
Weight.....lb..... oz. Gain.....oz. Since last report
Loss.oz.
Stools avg. in 24 hours.....Color.....Mucus
Curds.....Watery.....Loose..... Thick.....
Flatulency or cole?.....
Appetite: Is child satisfied?.....Is any food left?.....
Is the child comfortable and good natured?.....
How much does he sleep?.....
Date of last report?.....
.....
R.....F. S. P Cr. % Sk. M.....M. S.....
No feed.....Interval.....Dil.Aq.....Aq. C.....
Each 3.....Total 24 hr. 3

The child's first years are usually divided as follows, early infancy from birth to the twelfth month; infancy until the completion of dentition, usually about two and a half years, childhood from this time until puberty.

The measurements of the chest and head are given on page 55. It can be noted by reference to the table that at birth the head is greater in circumference than the chest; at the third year they are about equal, and from this time on the chest is larger.

The new-born infant should have regained its birthweight shortly after the end of the first week; by the end of the second week, gained 2 to 4 ounces; at 16 weeks its birthweight is usually doubled, and at one year of age it is usually three times its birthweight.

The most rapid growth of the infant during the first year is in its weight. Its increase in length in this period is about

8 inches, and after this it is at the rate of about 4 inches a year.

Any serious interference in this ratio, approximately, is an evidence of defective nutrition as a rule, and should receive prompt and careful attention. Schwartz ¹ has suggested the following tables for calculating the weight and height at different ages:

Weight first twelve months. Third to seventh month, add 10 to the month; other months add 8 to the month.

Example: Weight at 4th month? $4 + 10 = 14$ lbs.
Weight at 10th month? $10 + 8 = 18$ lbs.

Weight of a child at any age. Multiply the age of the child, plus 1, by 5, and add 10; except for the twelfth, thirteenth and fourteenth years add 15, 20 and 25, respectively.

Example: Weight of child at 4 years?
 $4 + 1 = 5$ $5 \times 5 = 25$ $25 + 10 = 35$ lbs.
Weight of child at 15th year?
 $15 + 1 = 16$ $16 \times 5 = 80$ $80 + 20 = 100$ lbs.

Height of a child at any age. Up to the sixth year multiply the year by 3 and add 26, after the sixth year multiply by 2 and add 32.

Example: Height of child at 4 years?
 $4 \times 3 = 12$ $12 + 26 = 38$ inches.

DENTITION.

The process of eruption of the teeth through the gums is dentition. A child may be born with a tooth through the gum, but these cases are most rare, and the teeth very soon become loose and fall out. The first teeth are the temporary, deciduous or milk set, and are composed of two central and two lateral incisors, two canines and four molars in each jaw. The teeth are found in the jaw about the sixth week of intrauterine existence. As nutrition proceeds the crown is completed, the root hardens and develops, and they are forced outward through the gums.

The eruption of the teeth is a physiological and entirely

¹ New York Medical Journal.

normal process, and should not be looked upon as the bugbear of infancy. It is very easy to state that any pathologic condition, especially gastrointestinal disturbances, occurring during the first five months, are due to the teeth, and not look to the diet, for instance, as a cause of the disturbance.

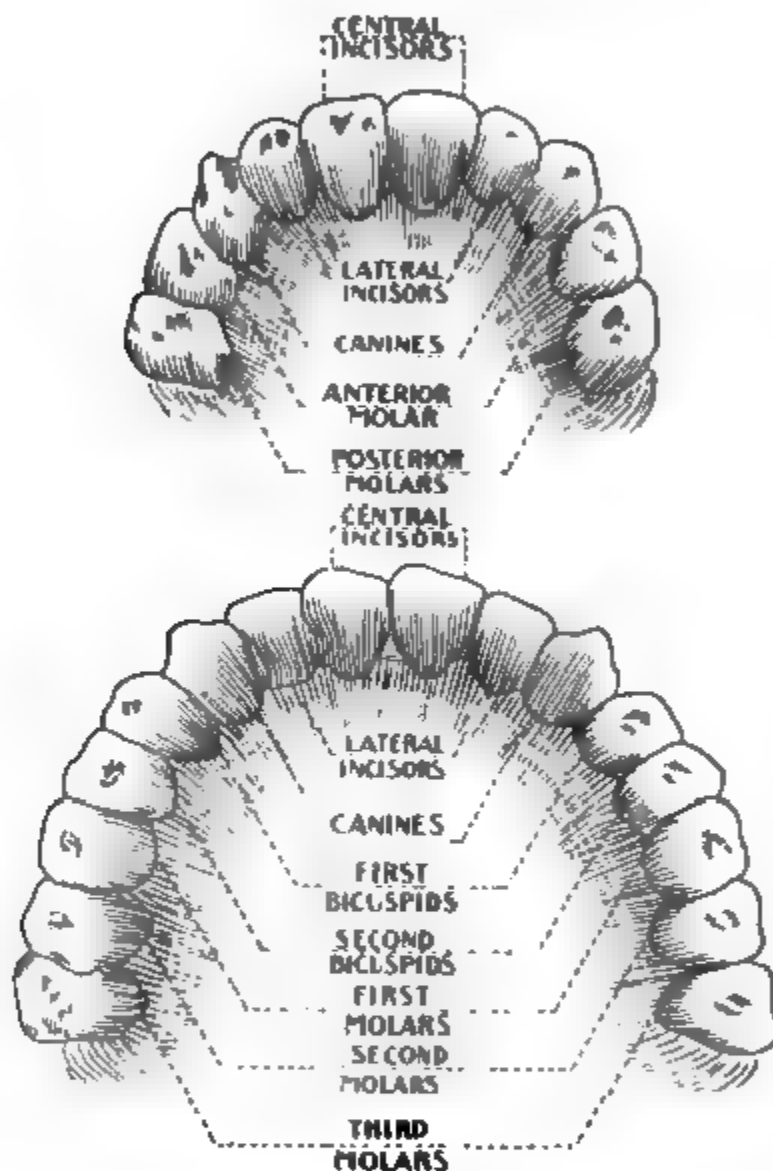


Fig. 11.—Temporary and permanent teeth.

Unquestioned cases of disturbance of digestion, vomiting or mild diarrhea; or mild but persistent cough, are seen during the early period of dentition, with more or less prompt relief of symptoms when the gum is penetrated by the tooth. Cases in which these symptoms are coincident with the eruption of a tooth are almost without exception subjects of other disorders, principally of nutrition. Much delayed dentition is usually due to rachitis. There is usually an active development of the

salivary glands some weeks before a tooth is cut, and there is a constant escape of saliva from the mouth during the waking hours. The child may be more restless than usual, and bite upon everything it can grasp with its hand.

It is in those cases which show some nervous symptoms and restlessness or which present some of the other symptoms enumerated, that the most benefit is had from making an incision through the gums. This does not retard the eruption of the teeth through the scar tissue which may form over the tooth, but relieves the tension and swelling of the gums and many or all of the symptoms. The child is held upon the lap of the nurse, who sits facing the operator. The child sits with its back to the operator, and with the nurse holding its hands its head is lowered between the knees of the operator and there held. With one hand holding open the gums and retracting the lip, the incision is made directly over the teeth with the other. It is generally not necessary to lance the gums over the molars, as they usually erupt one sharp prong at a time and without symptoms or difficulty. The first deciduous teeth to fall out are the upper central incisors, as a rule, the permanent teeth very shortly afterward coming in. The first milk teeth are lost usually at the end of the sixth year, the 20 occupying the site of these and are followed by the molars. The teeth usually appear as follows:

Two lower central incisors, six to nine months.

Four upper incisors, seven to ten months.

Two lower lateral incisors, 12 to 14 months.

Two anterior upper molars	} 12 to 16 months.
Two anterior lower molars	

Two upper canines (eye teeth)	} 18 to 24 months.
Two lower canines (stomach teeth)	

Two upper posterior molars	} 24 to 30 months.
Two lower posterior molars	

The permanent teeth usually are cut as follows:

Four first molars, six years.

Four central incisors, seven years.

Four lateral incisors, eight years.

Four bicuspid, eight and one-half to nine years.

Four bicuspid, ten years.

Four canines, 11 years.

Four second molars, 12 to 13 years.

Four wisdom teeth, 18 to 25 years.

An attack of acute illness, just at the time of the dentition, may seriously impair the life of the tooth.

CASE. Mother nursing infant of three months developed a severe typhoid fever. Baby removed at once and put on modified milk. In ten days or two weeks afterward child developed a typical attack of typhoid fever, which ran a mild but usual course. Very soon after the subsidence of the fever she cut her first teeth. She rapidly began to gain in weight, but a black line developed on the upper central incisors. This deepened and finally the teeth broke off through the line, short with the gums, and no other teeth have displaced them, though the child is now four years of age.

The deciduous or temporary teeth should be cared for with the same routine as the permanent set. They should be brushed twice daily with a soft tooth-brush or cotton mop, and regularly inspected by a competent dentist for any imperfections indicating softening. Nothing so completely upsets the nervous equilibrium of a child as the toothache, and should always be prevented.

Timely and proper removal of the deciduous teeth may prevent erratic cutting of the permanent teeth, which later will have to be straightened. Thumb and finger sucking, and the pernicious use of the "comforter," or rubber nipple, as a quieter or pacifier, is a frequent cause of deformities of the arch and displacement of the teeth.

Hutchinson's teeth are due to congenital syphilis. The upper central incisors are peg shaped and notched, with irregular ragged surfaces.

MENSTRUATION.

Menstruation usually begins in this climate between the thirteenth and fifteenth years of age. In 174 girls, inmates of the Masonic Widows' and Orphans' Home, the following were the ages recorded for the beginning of menstruation:

11 years.....	2
12 years.....	18
13 years.....	47
14 years.....	71
15 years.....	33
16 years.....	3
	<hr/>
	174

It was usual for these children to menstruate once, perhaps twice, then miss for several months, and begin again and with regularity. Very frequently one month, occasionally two months, were skipped in a year, without apparent cause. No special season was noted for this to occur. When more than three months were missed after regular periods had become established, attention was given, and a few weeks' tonic treatment usually resulted in its re-establishment.

CHAPTER V.

METHODS OF EXAMINATION.

Physical examination in pediatrics is our chief diagnostic aid, and all of the known methods should be employed: inspection, palpation, auscultation, mensuration and percussion, chemical

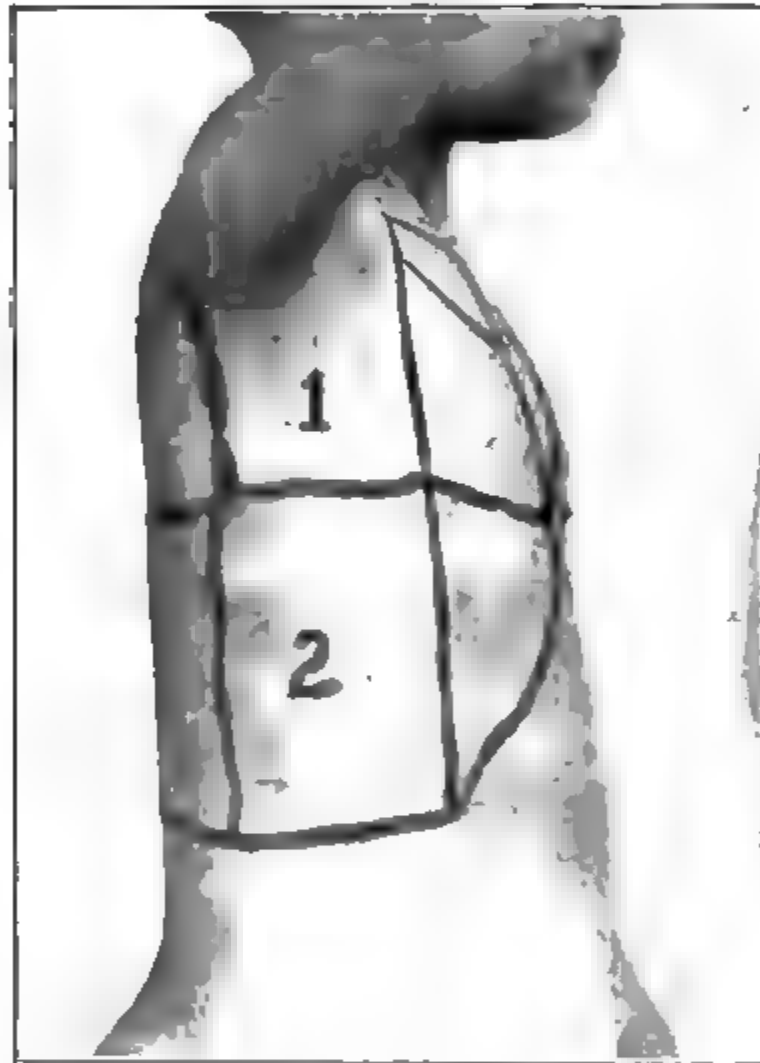


Fig 12 —1, Axillary region; 2, Infra-axillary region.

analyses of secretions and excretions, and microscopic examination of serum, blood, excretions and exudates, etc. The value of the information obtained from mother and nurse should not be minimized, but one should not be influenced by misleading and irrelevant statements.

A child should always be carefully inspected as it lies, especially if asleep; its position; color; respiration, character and frequency; dilatation of the *alæ nasi*; temperature of hands and feet.

Diplomacy yields best returns in a physician's interview with a child. If you once obtain its confidence the rest is easy. The child may be nervous, cross and irritable; will cry when touched; it may be almost vicious in its resistance to examination. Each



Fig 13.—1, Supra-clavicular, 2, Clavicular, 3, Infra-clavicular, 4, Mammary, 5, Hypochondriac, 6, Epigastric, 7, Sternal, 8, Umbilical, 9, Hypochondriac.

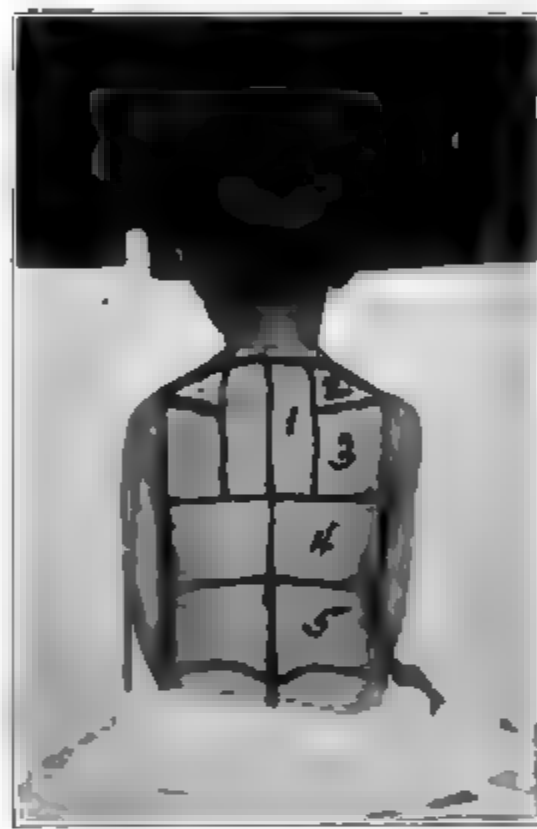


Fig 14 — Posterior Regions of Chest—1, Inter-scapular, 2, Supra-scapular; 3, Scapular; 4, Infra-scapular; 5, Lumbar.

child is an individual, and no method of approach will suffice in two successive cases.

Too much emphasis cannot be laid on the importance of careful history taking and recording the findings in every case. This is best done on suitable blanks which can be filled out at the bedside, and filed in card index systems. A daily resumé of symptoms and treatment are recorded and filed with the first chart. Previous illness, dentition, food, bowels, and the symptoms and course of present illness are carefully recorded, and

a daily record blank used afterward in connection with the case. A blank used by the author for the first history is shown here:

Name
Add
Ser. To

Prem.....

Born.....

Term.....

Labor.....

{

Duration

Cond. birth

{

Instrument

{

Vigorous.....

Respir.....

Convuls.....

Wt. at birth.....Breast fed.....Diet since.....
.....
Wt.
Teeth 1st
Crept..... Walked.....
Measles.....Pertussis.....Scarlat.....Diphth.....Grip.....
Tonsil.....Otitis.....Croup.....Bronch.....Pneumon....
Nervous sysSleep.....Adenoids.....

Note the child as it awakens, whether bright, quiet, peevish or crying; size of its pupils, color of skin, etc. A child cries for some cause as a rule. Kilmer gives the following 11 causes for a child's crying:

1, because it is hungry; 2, because it is in pain; 3, because it is thirsty; 4, because it wants attention; 5, it is sleepy; 6, its napkin is wet; 7, it is tired lying in one position; 8, it is frightened; 9, it is exhausted; 10, it is crying from temper; 11, it is uncomfortable, clothes wrinkled, etc. It must be remembered that a normal healthy child does not cry from choice.

Inspection should include a personal view of the napkins, especially if there has been any variation from normal in the evacuations. No description by nurse or mother is adequate to convey the real character of an action.

It should be determined whether the sight of the child is normal or impaired, if the pupils are equal, contracted, dilated or fixed. The presence of nystagmus, or side to side movements of the eyeball is noted. If the child is able to be up, the character of the gait should be noted. The reflexes also should be noted. The chief one is the knee reflex, obtained by tapping the tendon below the patella while supporting the thigh and allowing the leg to hang naturally.

Kernig's Sign.—The child lying upon its back with thigh flexed half way upon the abdomen, the leg partly flexed on the thigh, the leg cannot be extended.

Babinski's Reflex.—With leg extended and slight irritation of the plantar surface of the foot the great toe is fully extended, and the other toes partly flexed. This reflex is noted specially



Fig. 15 —Position for taking rectal temperature

in tubercular meningitis, though authorities differ as to its value as a diagnostic sign.

Sach's Sign of Chorea.—The child, standing before the examiner, is asked to repeat a certain sentence, and in the effort to do so there is a decided tremor of the hands, which are held in those of the examiner.

The cry of a child is usually characteristic. In cerebral affections the cry is shrill and sudden; in affections of the larynx it is hoarse, brassy, strident; with middle ear inflammations it is continuous and shrill and accompanied with pulling at the ear

affected; in colic the child cries loudly and intermittently, and continuously flexes and extends its legs and thighs.

Temperature.—As already stated the temperature of the child during the first year is usually between 99° and 99.5° F. An infant's temperature should always be taken in the rectum. If the mother has a thermometer hers should be used, and if not the physician should carry two, one for use in the rectum only. The child may be held upon the nurse's lap lying upon its abdomen, legs hanging down. With napkin off; the thermometer, well anointed, is carefully passed into the rectum and allowed to remain for two minutes. Half-minute thermometers are not reliable. The child may be placed upon its side, on the nurse's lap or in bed, with thighs flexed, but under no circumstances should the thermometer be inserted in the rectum with the child lying on its back with legs and thighs flexed, as it may raise the hips from the bed and break the thermometer.

After taking the temperature the thermometer should be carefully washed with soap and water and placed in alcohol for a moment. I have had some success with the clean shield rubber covering to the thermometer, which is thrown away as soon as used. The possibility of transmission of infection in girl babies of vulvovaginitis should be borne in mind. Groin or axillary temperature in a child is always unreliable.

I saw a child in consultation, ill with pneumonia, and from the extent of the consolidation was surprised at the temperature recorded being 102.5° F., it having been taken in the axilla. I requested it taken in the rectum and found it 105° F., which was more in keeping with the other symptoms.

Another case recently occurred in which the rectal temperature in a suspected typhoid was recorded as 97° F., with every indication of fever. A change of thermometers showed it to be 102° F. Examination of the first one revealed the fact that it was not self-registering, the mercury falling into the bulb as soon as it was removed from the rectum. These things must be borne in mind.

The *throat* of every sick child should be carefully inspected. The child is held facing a strong natural or artificial light, with back to the right shoulder of the nurse, who holds the child's

hands. The examiner with his left hand holds the head and with the right depresses the tongue with spoon or tongue depressor, and a quick view of the fauces, tonsils and uvula is obtained. Young infants are usually not frightened by a head mirror, though older children may be unless its use is explained to them. Owing to the fact that the tongue is high in infants



Fig. 16.—Examination of throat by direct illumination. Note position of nurse's hands, holding patient's head and hands.

and the soft palate and tonsils relatively low down, it is occasionally difficult, in them, to get a good view of the throat.

The importance of this examination cannot be too forcibly emphasized, as frequently severe attacks of diphtheria may develop without any pain or discomfort or inability to swallow being complained of. The use of the wooden tongue depressor, which is thrown away after using, is recommended instead of metal tongue depressor or spoon.

The mucous membrane of the mouth, cheeks and lips should be inspected for the presence of the *buccal eruption* of measles

(Koplik), which is referred to under another chapter, or for the presence of ulcers or deposit of thrush or sprue.

The *tongue* is inspected and its general condition noted:



Fig. 17.—Tongue depressor handle with removable wooden depressors.

whether the frenum linguae is short and inhibits the range of motion; if it is dry, coated, flabby, and shows the imprint of the teeth; if it presents the characteristics of the strawberry-tongue of scarlet fever, or if ulcers are present at any place on its surface.

Examination of the *middle ear* is a procedure too frequently

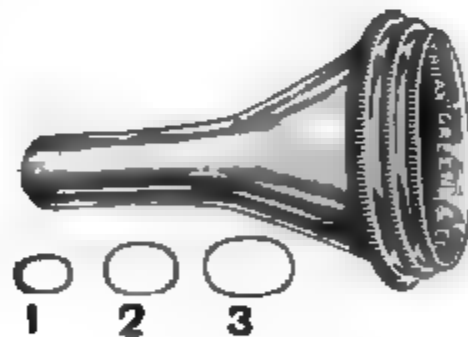


Fig. 18.—Ear specula.

neglected by the practitioner. Many cases of unexplained fever of some duration in children can be cleared up by an inspection of the drum membrane. A bulging congested drum means middle ear trouble. An inspection is made through a small size ear speculum (the lobe of the ear being drawn down, as suggested by Dr. Jas. F. McKernon of New York), by reflected

light from a head mirror. The child is held in the nurse's lap, the unaffected side against the breast of the nurse, her hand supporting the head and with the child's arms and hands, held by a sheet, wrapped around the body. With the light behind the nurse's head, and unobstructed view of the canal and the drum can be had by reflected light.

The *nose* should receive attention, as much may be found here to cause discomfort if not symptoms. The child is supported much as for a throat examination, with chin elevated and a good view of the entrance to each nostril obtained.

Hypertrophied turbinates frequently encroach on the space of the nostril, especially when there is an acute coryza. Concretions of dried discharge also may have to be removed before a view can be had. Anointing with vaseline, by means of a cotton-protected swab, gives great comfort in these cases. The habit of older children of putting foreign bodies, as shoe buttons, beans, etc., in the nostril and ears should be borne in mind. I recently removed a foot of a small china doll from the nose of a two-year-old child, experiencing some difficulty in getting a firm hold of it with a forceps.

The *skin* should be carefully examined for eruptions, and at this time the child's clothes must be entirely removed. Enlargement of the superficial glands must be looked for, axillary, post-cervical, submaxillary, epitrochlear and inguinal.

Palpation.—By palpation of the head the condition of the fontanelles can be ascertained, craniotabes located, if present, and enlarged glands in the occipital and postcervical region found. Palpation of the chest with a warm hand on each side of the anterior surface, then the posterior should be done to ascertain presence or absence of ronchi or rattles.

The ribs should be examined for beading and the epiphyses of the long bones for enlargement. The lower abdomen and inguinal region should be palpated for hernia, and the scrotum for hydrocele, hernia or undescended testicle.

The frequency of the heart beat can be determined by palpation of the apex beat, or feeling the pulse at the wrist, temple, groin or ankle. Its character can best be learned by palpation of the radial artery at the wrist. The frequency of the heart

can also be determined by auscultation over the apex, or inspection of the precordial region.

The abdomen should be carefully palpated to ascertain the presence of tumors or marked glandular enlargement; the muscle guard over an inflamed appendix; an enlarged liver or spleen. An enlarged liver may be determined also by percussion, but an enlarged spleen only by palpation. The presence of underlying distended intestine prevents percussion from being of value in investigating the spleen. An enlarged kidney may be diagnosed by abdominal palpation.

Rectal palpation is of great service in diagnosing sus-

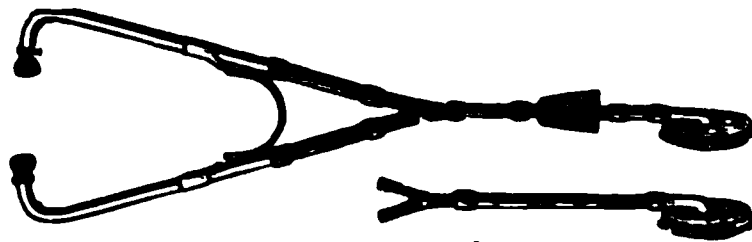


Fig. 19.—Bowles stethoscope with small chest piece.

pected cases of intussusception. This should be done with the utmost gentleness. Inspection of the rectum for fissure should be made whenever a child cries with the passage of his movements, especially if there is any blood with the action.

With patient on a table, lying on its face, the spine is inspected and palpated. If local bone changes (Pott's disease) are suspected the examination includes an effort to locate rigidity.

Auscultation of the chest is the most important aid to diagnosis of diseases located there.

A complete auscultation of the chest cannot be made without the aid of a stethoscope, either the binaural, bell stethoscope with small chest piece, or the Bowles stethoscope with the small chest piece. The child should be held so high that the examiner does not have to bend over, thus compressing his abdominal vessels, and causing a flushing of the face and ringing in the ears. It may either be held on the nurse's shoulder for examination of the back, or face down upon the nurse's lap. Auscultation of the axillary region in a child with the ear is impossible. I have seen one case of deep-seated pneumonia with only one spot the size of a 25-cent piece showing bronchial breathing, and

this was located in the extreme upper portion of the axilla where the ear could not possibly have been placed. Then, too, the ear covers too much space and it is impossible to localize a small area of consolidation.

As the auscultation is proceeded with comparison should be



Fig. 20.—Position for auscultation of back.

made of the two sides at exactly corresponding points. It should be remembered that the child's chest wall is thin and is a better conductor of sound than an adult's, the bronchial tissue is greater in proportion than the vesicular, hence the respiratory sounds, especially expiration, will be much higher-pitched than the adult's. In fact, when listening to a child's lungs, it is well to forget the sounds in an adult's chest, they are so different.

The sound over the upper third of the sternum and along the second and third interspaces is quite bronchial in character, es-

pecially on the right side, because of the larger size of the right primary bronchus and its angle at this point, allowing a larger volume of air to enter this side. This is true also over the interscapular spaces.

Auscultation of the heart should be systematic, listening over



Fig 21 —Auscultation of chest Comfortable position. Bowles stethoscope.

the apex, the base, and right second intercostal space, and if murmurs are present they should be traced and located.

Percussion.—Percussion over the chest may be performed with the finger as the pleximeter, and a percussion hammer, or with the index and second fingers of one hand as the hammer. The pleximeter finger should be placed the same on each side, if on the second rib on one side it must be similarly placed on the other, to obtain a comparison of sound. In percussing over the posterior wall, the presence of the liver on the right side under the ninth rib must be remembered, and not mistake the absence of resonance for consolidation or exudate in the pleural cavity. The area of dulness over the heart can be easily determined by superficial percussion. On deep percussion in this area, there

is apt to be transmitted resonance from underlying lung tissue.

Mensuration.—This is a valuable aid in diagnosis. A tape on a spring in a case which will roll up on pressing a release button is most satisfactory. The metal tape bearing the metric measurements on one side and English on the other is a very serviceable one, but the greatest objection is the chill which it causes when brought in contact with the skin.

In hydrothorax or pneumohydrothorax, the tape is of the greatest service in estimating the amount of effusion. In enlargement of the joints it is an assistance, also in ascertaining the



Fig. 22.—Stanton's percussion hammer.

presence or absence of shortening of the lower extremities, and of atrophy following infantile paralysis particularly. In making this measurement the comparison of the two sides is taken from the anterior superior spinous processes of the ilium and the internal malleolus of the tibia. The measurement from the umbilicus as the fixed point is relative only.

A useful tape in comparing the expansion of the two sides is made by sewing together two tapes at 1 inch end, this junction being held upon the spine as deep inspiration is taken.

The comparative measurement of the head and chest is of value also. The circumference of the head is taken around the middle of the forehead and over the parietal bosses, and around the nipples for the chest.

Measurement of the height of the child should be regularly made and recorded to ascertain if its growth is progressive and regular.

CHAPTER VI.

THERAPEUTICS OF INFANCY AND CHILDHOOD.

There should always be a clear indication for medication in children, and no remedy employed without the indication is present. Children respond readily to therapeutic measures, and this should be borne in mind in dosage.

Young's method of figuring the dose of a given medicine for a child is as follows: Add 12 to the age of the child and divide the age by this sum, which will give the proportionate quantity of the adult dose.

Example: If the age of the child is two years:

$$2 + 12 = 14 \quad 2 \text{ (the age of the child)} \div 14 = \frac{2}{14} \text{ or } \frac{1}{7} \text{ the adult dose.}$$

Cowling's Rule.—Divide the age of the child at its following birthday by 24, the result being the proportionate adult dose for the child.

Example: If the child is two years old, $2 \div 24 = \frac{2}{24}$ or $\frac{1}{12}$ the adult dose.

No medicine should be given a child under three years of age, in *pill* form, owing to the possibility of the pill being aspirated into a bronchus. It is a good plan to teach children to swallow pills by making a mass of bread, as much that is disagreeable to the taste can be administered in this form.

Powders are not well taken by children, and should either be dissolved or suspended in a watery solution or in an emulsion. If a powder is given dry it is very apt to gag the child as it gets in the mouth or some of it may be aspirated into the larynx and cause violent coughing.

Enemata are as a rule well borne. If *nutrient*, they should be given half high and never in very large quantities. Two

ounces is as much as will be taken care of as a rule, and they should not be repeated too frequently. Nutrient enemas should be predigested as the bowel at this point will absorb but not digest. Owing to the loose mesentery of the sigmoid flexure, and the relative greater length of this portion of the bowel, a child requires a larger quantity of fluid for purposes of *evacuation* than is usually given. The pressure of the fluid in the bag should not be very great, the bag not being more than 3 feet above the patient. The Davidson syringe should never be used on an infant. It is impossible to keep this kind of syringe clean, and one cannot gauge the amount of pressure exerted on the resistant bowel. The use of the high, copious enema for the purpose of reducing an intussusception is a remedy which if used at all should be used with the greatest caution.

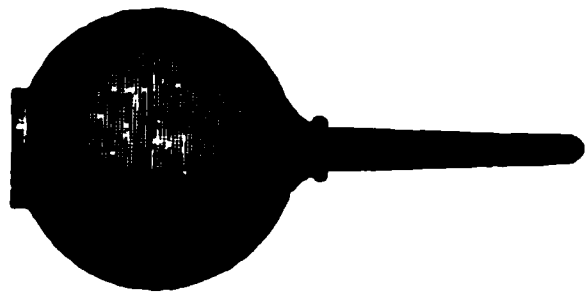


Fig. 23.—Rubber bulb syringe.

Suppositories are efficient and, if not too large or too often repeated, can be used as a means of medication or to evacuate the bowel. For the latter purpose the long glycerine pencil is very practical and very efficient. In writing a prescription for a suppository directions should always be given that they be small.

Inhalation.—In older children much good can be accomplished by a croup kettle or steam atomizer. The small steam atomizer is placed at the side of the bed and a sheet so arranged as to cover three sides of the bed; in this way the child constantly breathes moist air, which can be either with or without a medicament. Benzoin is a very soothing remedy and may be added to the water in the atomizer.

In older children the inhalation can be given by making a paper cornucopia to the top of a pitcher or Mason jar holding hot water. The face is held over this and deep inhalations taken of the plain or medicated vapor.

In spasmodic croup, or true croup (diphtheria), especially when a tube is worn in the latter, the moist air is of the greatest help.

Gargles.—May be employed in older children when indicated.

A child has to be taught to gargle, as a rule, and usually in a few attempts will succeed.

Hypodermoclysis.—In certain conditions where there is a septic condition or a marked collapse from any acute or wasting disease, this method of treatment yields excellent results. *Enteroclysis*, referred to elsewhere, especially by the continuous method, is of great service also.

In hypodermoclysis, a normal salt solution, approximately one teaspoonful of salt to a pint of distilled or filtered water, is injected into the cellular tissue of the skin. These injections should be at a temperature of 100° F., and in quantities not to exceed 40 to 50 cc. at a time. Careful sterilization of the needles and apparatus, and of the skin should be obtained. It can be given with a fountain syringe, or a large antitoxin syringe, such as were formerly used for the injection of diphtheria antitoxin.

Calomel Vapor Inhalations.—A tent is made in the same way as for steam medication, the steam started and 10 grains of calomel sublimed in the tent, its fumes being added to the steam. The calomel can be heated in a spoon held over a candle or alcohol lamp, or in specially devised sublimers. This form of treatment was used formerly more frequently than of late, especially in diphtheria affecting the larynx.

Medicinal Antipyretics should be used in children with great caution, this being specially true of the coal-tar products, antipyrine, acetanilid, antifebrine and phenacetine. Children bear hydrotherapeutic measures very well indeed, and these should be used to the exclusion of the medicinal antipyretics in all forms of hyperpyrexia. If it is necessary to give them, the use of caffeine at the same time is advocated.

Stimulants are well borne as a rule, alcohol in some form: strychnia, nitroglycerine, sparteine, digitalis, all being well borne by children. Alcohol in certain conditions is the best form of stimulant, as in the crisis of lobar pneumonia, late in typhoid fever, diphtheria and the exanthemata. It should be well diluted, at least 1 to 6 or 8 parts of water, and if whisky is used, a good straight, bottled in bond, article should be insisted upon. Do not begin the use of alcohol in the beginning

of any illness and not at all until there is a positive indication for it. It may, under conditions where the stomach will not retain it, be given by the rectum, but in larger quantities and the same dilution. Brandy will often be tolerated when whisky will not.

Camphor is a diffusible stimulant, and may be used by hypodermic injection in olive oil, $\frac{1}{2}$ or 1 grain in 20 drops of olive oil.

Anodynes.—Children are peculiarly susceptible to anodynes, and they should be given with great caution. Opium, in any form, should never be given mixed with other drugs in a prescription. It can be given at the same time, but added to the mixture at the time of giving. In this way a relatively large dose can be given as a rule. Chloral is also well borne and can be given by the stomach or bowel.

Counter Irritants are easy of application owing to the delicateness of the child's skin. Mustard, turpentine, chloroform, in the form of sinapisms or liniments; iodine must be used with caution to guard against blistering. Blisters are easily raised when desired by cantharides in form of plaster or collodion.

Weak mustard plasters in my hands have been of greater service than a strong mixture. One part of mustard to 6 or 8 parts of flour is very efficient and soothing. In bronchitis, bronchopneumonia, pleurisy and intercostal neuralgia the application of a mustard plaster is of the greatest efficiency.

The Bath.—The bath is a most important and useful means of combating certain symptoms in children. It is the most important antipyretic measure, and if children are early taught to enjoy the bath and are not frightened by being plunged into too cold water, it will always be a pleasure to them to be bathed.

A bath thermometer should be a part of the equipment of every nursery, and the temperature of the water accurately taken. Do not use the child as thermometer, "if the water is too cold the skin turning blue, and if too hot the skin turning red." When used as an antipyretic the water should at first be about 95° F. and cooled to 75° F. or 80° F., according to its effect on the child. The tub should be large enough to allow the child to recline, its head supported by the arm of the mother

or nurse. If the bath is given in a porcelain tub, a bath towel is laid on the bottom so the child will not slip about, or the cold tub be disagreeable. Cold water or ice water is added at one end of the tub, away from the child, and the water thoroughly mixed. The child is gently rubbed, legs and arms, back



Fig. 24 —Collapsible rubber bath tub.

and chest, during the entire time it is in the water. If the teeth begin to chatter and the child to shiver, the bath should not be prolonged. No hard and fast rule can be given as to the duration of the bath, as children react so differently. An average duration of ten minutes is the proper length of a bath for its antipyretic effect.

Should a child object to the bath from fright, it can be lowered into the water in a sheet stretched across the tub, the water gradually covering the body.

The rectal temperature should be taken just before the bath, and 30 minutes afterward. If the child still feels hot when it is removed from the water and is dried, increased radiation can be accomplished by rubbing with a weak solution of alcohol, 1 tablespoonful to 6 ounces of water, allowing this to evaporate, the sponging being continued for five or ten minutes.

A preliminary bath before the physician arrives in the presence of temperature above 103° F. is always indicated, and

mothers should be told to do this without further instructions.

In older children the regular bath should be a delight instead of a bugbear. In those who are susceptible to "colds," a cool bath, or the cool sponge, of the chest and back following a warm bath each morning, this followed by a brisk rub, is of the greatest benefit. With some children the spinal douche of cold water can be employed, but not very frequently. Some children prefer a cool bath, always. I have two boys under my observation, aged 4 years and 18 months, who have a daily bath in water between 55° F. and 60° F., and object to a temperature even as high as 70° F.

In hot weather, a second bath at night before retiring gives great comfort and insures a good night's rest.

Bran Bath.—Two teacupfuls of bran, in a cheese-cloth bag, to enough water in the tub to cover the child's legs when sitting in the water, is of great service in itching, irritated, skin, due to urticaria and prickly heat. The water is splashed on the body and the skin is not rubbed. The temperature of the water should be below 80° F. On removal from the tub the skin is quickly dried with soft towels, without friction, and the surface freely powdered with talcum.

Soda Bath.—In urticaria, especially, a general soda bath gives much comfort, or a basin bath may be used, the solution being "sopped" on with soft gauze or washcloth. If a general bath is given use a half teacupful of the bicarbonate of soda to the quantity of water used for the bran bath, or a tablespoonful of the soda to a pint of water for the basin bath. This is allowed to dry on the skin naturally.

Mustard Bath.—For pulmonary affections the mustard bath is of the greatest service. It can be used with benefit also with children in convulsions, or very nervous and irritable ones. Two heaping tablespoonfuls of Coleman's powdered mustard are dissolved in five gallons of water, through a cloth or gauze, in order to prevent its floating on the surface, and sticking to the sides of the tub. Care should be exercised to prevent the child rubbing its eyes with its hands, wet with the mustard water. The mustard bath is given at a temperature of from 95° F. to 100° F., and can be cooled to 85° F., just before child is re-

moved. The child is rubbed vigorously between blankets and put in bed at once after being dried.

Brine Bath.—In feeble and poorly-nourished children the salt or brine bath can be used with benefit, as it acts as a tonic and, as a rule, an excellent reaction is obtained. Ordinary salt, or if it can be obtained, sea-salt, can be used, one or two tablespoonfuls to the gallon of water. A basin bath with soap and water can first be given, and the child then put in the salt water, the skin being rubbed constantly for the five or ten minutes it is kept in the water. The reaction from this bath is usually greater than from any other form.

Nauheim Baths.—The artificial Nauheim-Schott treatment¹ consists in the use of brine baths, with or without free carbonic dioxid. Their object is to enable a dilated heart, that is unable to expel its contents, to empty itself completely.

Briefly, the effects of the baths are obtained by the temperature, duration and amount of salts and gas contained in them.

The average temperature to begin with, is 92.7° F., the reduction not more than 2.2° F., the duration usually not longer than 10 minutes. The minimum temperature of any bath is 81.5° F., the maximum duration of 20 minutes.

Commercial bicarbonate of sodium and crude hydrochloric acid (42 per cent) are added in equal quantities by weight to the bath water. In the beginning one-fifth of a pound of each is added to 62 gallons of water, this quantity gradually increased to three pounds of each. The bicarbonate of soda is first dissolved and poured into the bath water and the acid added when everything else is ready. It is added by pouring it along the bottom of the tub under the water. The layer of carbon dioxid formed on top is removed by fanning, the window being open.

Wet Cool Pack.—As an antipyretic measure this is probably the best, and one which is infrequently used by the profession as a rule. It can be used with a child at any age, and may be continued for long periods at a time, 10, 12, or as in a case reported by Kerley, for 72 hours. The bed is protected by a rubber sheet, which is covered with a draw sheet. The child

¹ Nothnagle's Encyclopedia—Diseases of the Heart.

is then stripped, its legs being covered by a blanket. A large bath towel is used in preference to a sheet. This envelopes the child's chest, and is pinned loosely enough to go over the shoulders, like a baby's pin blanket, leaving the arms free and extending down as far as the middle of the thighs. With bath thermometer in the basin of water at the bedside, the temperature of the water is carefully watched. The rectal temperature of the child is taken at half-hour intervals in order to learn the rapidity of the fall. The pack is first put on dry.

The towel is wet thoroughly with water at 90° F. or 95° F., in order not to shock the child, the water being put on the towel from a piece of gauze which is squeezed on it, the child turned in order to have the back wet. In five or ten minutes the water is cooled 5° F., and the towel again wet in the same way. A child with a temperature of 105° F. quickly dries the towel. It is the aim to keep it wet constantly. Each time the towel is wet the water is cooled until it reaches 70° F. Heat to the feet and cold to the head is a great assistance. An ice bag may be laid against the head or cold cloths applied to the forehead and vertex. The pack is removed when the temperature is reduced to 102° F.

This treatment is indicated in all forms of pyrexia, from whatever cause. Pneumonia, the exanthemata, typhoid fever, etc. The presence of a rash is no contraindication, though some difficulty may be experienced in some families to convince anxious mothers and friends that it will not "drive in the rash."

Mustard Plaster.—If properly applied, a mustard plaster is of the greatest benefit in certain conditions of the respiratory tract, and where counter irritation for any reason is desired. The plaster made at home is more effective and less disagreeable than the mustard leaves on the market. If the skin is delicate and irritable, 1 part of the mustard to 8 or 10 parts of flour will be found very serviceable. The mustard flour and the wheat flour are made into a thick paste with cold water and spread between two thin pieces of cloth, warmed before the fire and placed upon the skin. The plaster is allowed to remain on the skin until it is reddened, which can be ascertained by lifting up the corner of the plaster. After removal the skin is greased with vaseline, and when the skin has resumed the normal hue

the plaster can be renewed, a fresh one being made each time.

Irrigation of the Nose.—The child is placed on the nurse's lap or on the bed, lying upon its side, its head slightly lower than its body. The child can be held upright, sitting on the nurse's lap, its head bent slightly forward over a basin. With either a fountain syringe or glass syringe, with a rubber tip, the solution, warmed to 90° F., is put into the upper nostril

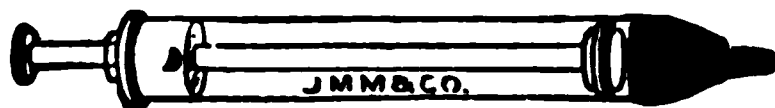


Fig. 25.—Glass syringe. Soft rubber tip.

and allowed to run out of the lower nares. The child may have to be wrapped in a sheet to confine its arms and legs, if it resists the operation very much.

Stomach Washing.¹—Epstein of Prague, in 1880, recommended washing the stomach in certain diseases of the gastrointestinal tract. Dr. A. Seibert of New York, in 1888, advocated its use, and since then lavage has been extensively used.

The apparatus used is a No. 13, American scale, soft rubber catheter, not too flexible, about 12 inches in length. This is attached to a piece of rubber tubing 2 feet long, with a short piece of glass tubing between. A glass or hard-rubber funnel of 2 or 3 ounces capacity is attached to the free end of the rubber tubing.

Plain lukewarm water previously boiled is the only fluid which should be used, and as a rule 1 pint is all that is necessary.

The child is seated upright in the nurse's lap, head against her right shoulder. A rubber apron is pinned around the child's neck, its lower end, long enough to reach the floor, in a basin or bucket, in front of the nurse's feet. The child's hands are held by one of the nurse's hands, its legs by the other. The child's tongue is depressed by the left forefinger, and taking advantage of the gagging the tube is rapidly pushed down the esophagus to the stomach. The tube is wet before being introduced and no lubrication is needed.

Some gas may be in the stomach and fill the tube, which will obstruct the inflow of the first water poured in the funnel, or

¹ "Stomach Washing in Infants," Tuley, Medical News, July 1, 1893.

which is less usual, a curd or bit of mucus may clog the eye of the catheter for a few moments. Filling the funnel and elevating it to the fullest extent usually causes the water to flow in. Through the glass tubing the flow of the water can be seen.

Over-distending the stomach with water causes the child to

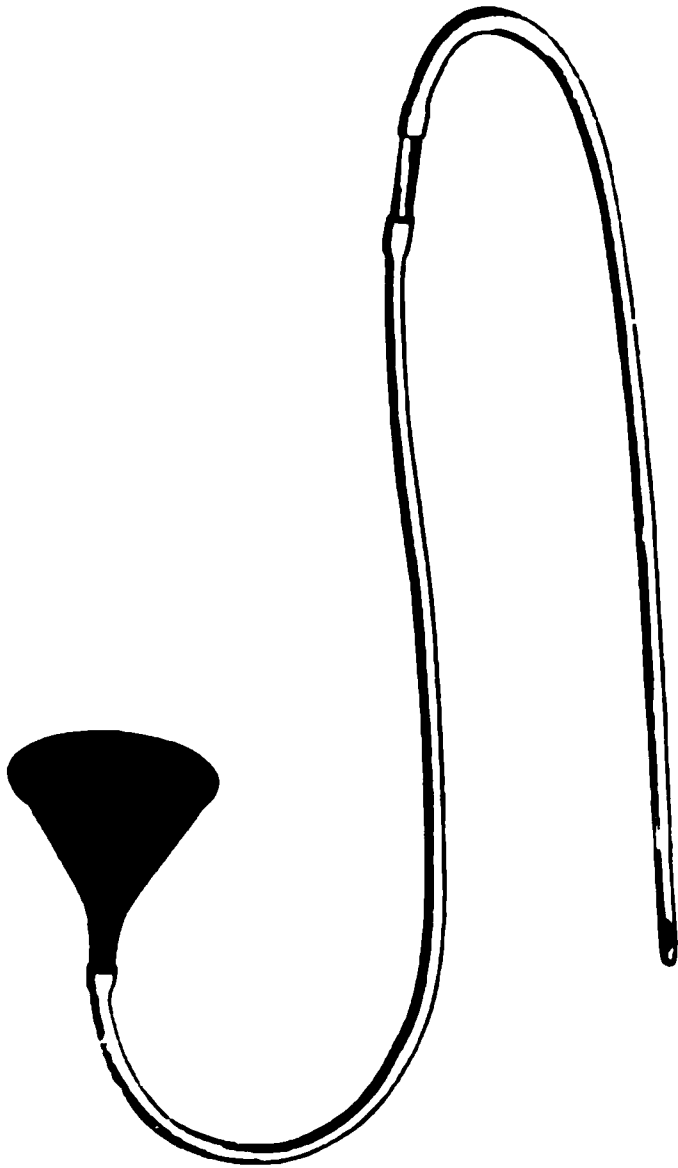


Fig. 26.—Apparatus for stomach washing.

vomit alongside the tube, and frequently thick leathery curds are ejected which could not have readily been disintegrated.

The water is siphoned out as soon as a proper amount has been allowed to run in and the process repeated until the wash water returns clear.

In removing the tube it should be grasped firmly in order to prevent a few drops falling into the larynx as the tip of the catheter passes over the epiglottis.

After the washing, the stomach should be kept entirely at rest, and only the easiest digested food administered. Epstein suggested the administration of egg albumen water for 24 hours after a stomach washing.

Irrigation of the Colon.—This is a measure frequently abused and improperly applied, yet one which is of great benefit when properly used. It has been suggested as an antipyretic measure, but this should be done with great caution. The indications for colon irrigation are referred to elsewhere.

A No. 14, American scale, soft rubber, velvet-eye catheter, or a No. 17, American scale, rectal tube with opening in the



Fig. 27.—Colon irrigation. Nurse's lap protected by rubber sheet.

end, is attached to the small tip of a 2 quart fountain syringe. The solution and its temperature should be determined by the indications to be met. The syringe is held not more than 3 feet above the patient, and the first of the water in the tube allowed to escape so it will run in an even temperature.

The child is held either on the nurse's lap, which is protected by a rubber sheet, or on a bed, close to the edge, on its back or left side with hips elevated, and clothes drawn well up under its shoulders. A napkin can be pinned loosely around its waist

and allowed to hang loose over the rubber sheet. A receptacle of some kind is placed under the rubber sheet to catch the return water.

The tube or catheter is anointed thoroughly with vaseline, and also the anus, as this will make it much easier to introduce the tube. After the tube has been inserted 1 or 2 inches the compression is removed from the tube, and as the water flows in it dilates the colon ahead of the tube, making its insertion easy as a rule. If straining occurs, the tube is compressed for a moment until the spasmodic condition is relieved. If a too flexible tube is used, as the tip meets a fold of bowel, it is apt to be bent on itself and forced out at the anus during straining.

The continuous irrigation already referred to is a measure of the greatest benefit in conditions such as sepsis, and failure of elimination by the kidney. The hips are slightly elevated and a medium-size catheter is introduced half way into the bowel. The bag is elevated not more than 12 inches above the hips, and enough compression used on the tube to cause the water to escape in drops, at a rate so that an average of a pint will escape an hour. The temperature of the water is kept at 100° F., by the addition of hot water from time to time as it cools.

Collection of Urine for Examination.—Unfortunately the chemical examination of the urine of children is very often neglected, or even entirely omitted by the average practitioner, and probably no other method of diagnosis is of greater importance to the clinician. In very young babies it is often a very difficult thing to obtain a specimen, especially girl babies, and a most useful device has been suggested by Dr. Chapin,¹ which he describes as follows:

It consists of a circular opening ending in a funnel that fits in a collecting vessel. Two sizes have been found necessary, small and large, designated respectively as No. 1 and No. 2, for infants under and over one year. The urinal is fixed in place by putting the large opening around the vulva in the female, and over the parts in the male, with the funnel pointed downward. Tapes are put through the openings in the arms and fixed by tying around the abdomen and both groins. To fix more firmly in place, strips of adhesive plaster may be pasted over the arms. The end of the

¹ American Pediatric Society. (Archives of Pediatrics, May, 1906).

funnel is placed in a collecting bottle which is kept in position by the diaper. If the baby is very restless, a cork may be put in the end of the funnel and the bottle dispensed with, as enough will often be thus collected for examination.

If the child is too ill to be held over a vessel at intervals, if a rubber napkin is put on with a small pledget of cotton at the nates, some urine will soon be caught, enough for a chemical and microscopical test. It should be borne in mind that any powder used about the vulva may contaminate the urine.

As an example may be mentioned the case of pyelitis referred to elsewhere. The urine from this patient was submitted to an expert clinical pathologist who found pus and albumen in the urine and also an object under the microscope resembling the egg of an intestinal parasite. It was finally remembered that lycopodium was used with talcum powder with this child, and these objects were the seed pods of the lycopodium.

Inunction.—The skin can be used for introducing medicines into the system, though it is a very uncertain method. In athreptic and marasmic children some absorption of fat can be obtained by inunction, and by enveloping the child in cotton soaked with oil, mercury can be introduced through the skin by rubbing the ointment into the flexures, using these alternately.

CHAPTER VII.

INFANT FEEDING.

Infant Feeding.—All forms of food contain essentially the same ingredients viz., proteids, fats, carbohydrates, mineral matter and water. From conception until about one year after birth, the supply of nourishment is obtained from the mother. By this time the infant's digestive tract is developed sufficiently for it to care for soft food and exist independently of the mother.

Breast Feeding.—No substitute has ever been found for normal mother's milk for the nourishment of the infant. Mother's milk contains the food elements, fat, sugar, proteid, mineral water and salts, in the proportions best suited for its digestive capacity and nutrition. The infant should be put to the breast as soon as the mother has had a rest from her labor, as the colostrum, present in the breast before labor, is essential for its purgative effect on the child. During the first 24 hours the child should be nursed every six hours; during the second 24 hours, every four hours; during the third 24 hours, every three hours; during the fourth 24 hours, every two hours. The milk usually comes the evening of the second or the morning of the third day, after which time the nursing should be every two hours. If nursed every two hours during the first three days the tugging and pulling on a flabby, empty breast results in an erosion or fissured nipple.

A cracked, fissured or eroded nipple is a most painful and distressing condition, as well as a dangerous one from the possibility of an infection of the breast occurring through this open wound. A fissured or eroded nipple should not be nursed from directly, but protected by a nipple shield. The glass shield with rubber nipple and guard is the most serviceable, and if filled with warm water when applied to the breast will encourage the child to pull when the nipple is placed in its mouth. Immediately after each nursing the nipple should be painted with a solution

of nitrate of silver, 20 grains to the ounce of water, care being taken to limit the application directly to the affected part. This forms a pellicle from the coagulated albumen of the serum, and allows granulation to occur beneath it. The nipple is then covered with a piece of sterile gauze or soft linen.

After the milk comes, the nursing should be by schedule, every two hours during the day and every three hours at night: From 6 a. m. to 10 p. m. every two hours, and one or two nursings at night. Under no conditions should a baby be allowed to sleep with its mother; the danger of over-laying is great, as is the danger of the child nursing most of the night. This always results seriously to the child's digestion.

Schedule for nursing a breast-fed baby:

AGE.	INTERVAL DAY.	NUMBER NIGHT NURSINGS.	NUMBER OF NURSINGS 24 HR.
First three days.....	4 to 6	1	4 to 6
Until end of first month..	2	2	10
Second and third months.	2½	1	8
Fourth and fifth months..	3	1	7
Sixth to twelfth months..	3	0	6

The child should nurse from one breast at each nursing, alternately, and should be satisfied in from 10 to 15 minutes. If it must be nursed from both breasts each time, and is unsatisfied when the nursing is finished, the quantity is inadequate for its needs. By regularity being established early both the baby is trained to good habits, and the breasts to secrete at regular intervals.

The nipples should be washed before and after nursing with a solution of boracic acid, and the child's mouth thoroughly cleansed before and after the nursing with the same solution.

It should be a rule to give water to a nursing baby between feedings. Before the milk comes, in order to prevent a too rapid loss of weight, there should be given at regular intervals a 2 per cent solution of sugar of milk, or even plain sterile water.

There are but few *contraindications* to maternal nursing. A severely inverted nipple makes it impossible for the child to nurse. Nursing should not be allowed in mothers suffering

from tuberculosis in any form; malignant disease; diphtheria; rheumatism or chorea; acute contagious diseases and pneumonia; erysipelas; albuminuria; typhoid fever, as the typhoid bacillus is excreted in the breast milk; the acute exanthemata; pregnancy occurring during lactation; epilepsy or nephritis, or if the mother has suffered from puerperal hemorrhage, nephritis, eclampsia or infection.

Nursing Mother.—A nursing mother should lead a perfectly normal, healthy life. Her diet should be generous and varied. There are practically no articles of diet which, if they agree with the mother, will cause the milk to disagree with the child.

During the first three days of the puerperium the diet should be light and easily digested. The following sample diet list for the first few days will generally yield good results:

First day (after labor):

Breakfast—Cup of tea, or cocoa; piece of dry or buttered toast.

Lunch—Beef, chicken or mutton broth; toast or wafer.

Supper—Glass of milk, or cup of tea.

Second day:

Breakfast—Cereal and cream with cocoa or tea.

Lunch—Soft-boiled egg, rice and cream.

Supper—Milk toast, tea or milk.

Third day:

Breakfast—Soft boiled egg, cereal, coffee or milk.

Lunch—Baked potato, gelatin jelly and cream, and milk.

Supper—Baked apple and cream or milk toast.

Fourth day (after bowels have moved):

Breakfast—Cereal, poached egg on toast, breakfast bacon, and cocoa or milk.

Lunch—Squab or bird, potato chips or baked potato; cocoa.

Supper—Mush and milk.

Fifth day:

Breakfast—Cereal, broiled steak, hashed brown or baked potato; milk.

Lunch—Chicken, broiled or baked; mashed potatoes, sweet potatoes, asparagus tip salad.

Supper—Milk toast.

Sixth day:

Breakfast—Lamb chop, soft boiled or poached egg, toast, cocoa and milk.

Lunch—Junket, cocoa, spinach, potato.

Supper—Baked apple or prunes, toast and milk.

Bran muffins made of bran and flour, equal parts, are especially useful during this period as a prevention of constipation.

- Strict attention should be paid to her bowels, and at least one evacuation had daily. It must be remembered, however, that there are a few purgatives which are excreted through the milk. I have frequently noticed a purgative effect on the child when the mother had been taking cascara in some form. She must have at least a half hour's exercise in the open air daily and longer, if possible.

If the child is satisfied after nursing and during the interval; is gaining in weight regularly; is happy and bright; it may be asserted the milk is both up to the standard in quantity and quality. If the child is satisfied but a short while after nursing, soon shows signs of hunger and the supply apparently adequate, then it is deficient in quality. If a milk is normal in amount, but deficient in certain ingredients, it can often be corrected and made to agree with the child.

The Method of Nursing.—Primipara should be instructed in the proper method of putting the child to the breast and holding it while nursing. During the puerperium, the mother lying partly on her side, the baby is put to the breast so it can readily grasp the nipple, which has been previously prepared, and one finger depresses the gland so that it will not press upon the nose and interfere with its breathing. The baby can either be supported upon the arm or lie flat upon the bed, the mother's arm being raised.

Holding the breast so as not to obstruct the child's breathing is most important. I know of one normal baby when 12 hours old entirely asphyxiated from being allowed to bury its nose in the breast.

When able to sit up to nurse, the mother occupies a low chair with a footstool, upon which rests the foot of the side from which the baby nurses. The baby is held upon the arm, and the mother leaning forward slightly places the nipple squarely, not obliquely, in mouth.

Breast Milk.—Breast milk is more bluish-white than yellow, and has been shown by Kerley and others to be faintly acid

when tested with 1 per cent alcoholic solution of phenolphthalein. By others it is claimed breast milk is amphoteric, that is, it is alkaline to red litmus and acid to blue litmus.

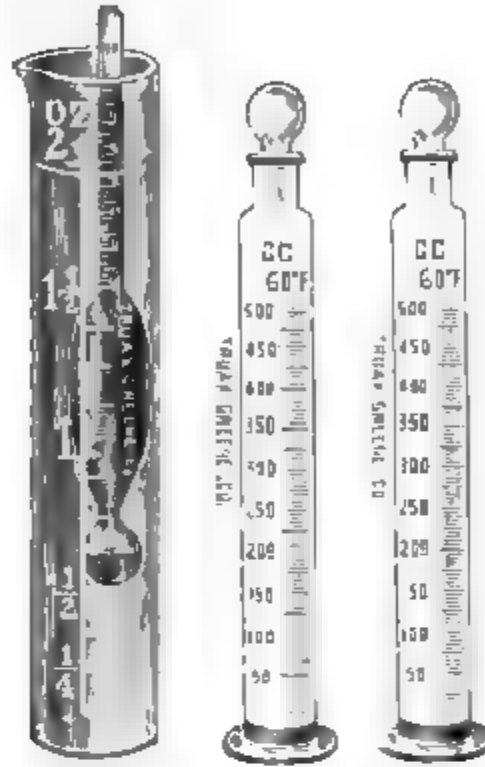


Fig. 28 Holt's milk set

The following table is given by Holt, showing the composition of breast milk:

	Average Per cent.	Common healthy variations Per cent.	
Fat	4.00	3.00 to	5.00
Sugar	7.00	6.00 to	7.00
Proteids	1.50	1.00 to	2.25
Salts	0.20	0.18 to	0.25
Water	87.30	89.82 to	85.50
	100.00	100.00	100.00

Milk must be thought of as a homogeneous mixture, its chief ingredients being fat, sugar and proteids, and the percentages of these must be definite and stable if the milk will agree with the child. The usually accepted analysis of mother's milk shows, fat 3.5 per cent, sugar 6 per cent, proteids 1.5 per cent.

An examination of breast milk by means of the Holt clinical milk set will show a more or less wide variation in the proteid and fat content in the same individual at different times of the day. There is always wider variation in these constituents than

in the sugar, which is more or less constant. As already stated, the quantity of the milk may be sufficient for the child's needs, but the quality much below. The quantity obtained at a feeding can be determined by weighing the child before and after nursing, as was done in a number of cases by the writer, which were reported in the Archives of Pediatrics (May, 1893).

Each baby was weighed with all of its clothes on before and directly after each nursing, with the nurse's and mother's assistance, being sure that the baby was kept awake during the entire 20 minutes it was allowed to nurse. The weighing was carefully done upon one of Fairbanks' scales which registered in half ounces with no change being made in clothing between weighings. Elimination of error was by this means made possible which might occur from loss in weight by excrement from the child or from a difference in the texture of the napkins applied. Eight babies were weighed, 64 weighings being recorded. The babies were from two to ten days of age, healthy, and all weighing 6 pounds or more at birth.

<i>Age Days</i>	<i>Number of Weighings</i>	<i>Aver. weight of ingested milk Ounces</i>
2	2	1.25
3	13	1.3
4	3	1.0
5	10	1.5
6	6	1.25
7	13	2.27
8	6	2.25
9	8	2.5
10	3	2.5

Given a case in which there was but little gain after a week's nursing or in which there is continued colic or curds passed in large quantities, the breast milk should be examined. This may be done clinically by Holt's Milk Set, or chemically, for an accurate estimate of the fat, proteid and sugar content, or by the use of the pioscope. The Babcock test may be made for the estimate of the fat content, which when taken in connection with the specific gravity will give a fairly accurate idea of the quality of milk.

The child should be put to the breast and allowed to nurse for three minutes, and a half ounce of milk either pressed or pumped from the breast, and if enough cannot be obtained from one side the other is treated in the same way.

Holt's directions for the use of his milk set are as follows:

The simplest method is by the cream-gauge. Although its results are only approximate, they are in most cases sufficiently accurate for clinical purposes. The tube is filled to the zero mark with freshly drawn milk, which stands at room-temperature for twenty-four hours, when the percentage of cream is read off. The ratio of this to the fat is approximately five to three; thus 5 per cent cream indicates 3 per cent fat, etc.

Sugar. The proportion of sugar is so nearly constant that it may be ignored in clinical examination.

Proteids. We have no simple method for determining clinically the amount of proteids. If we regard the sugar and salts as constant, or so nearly so as not to affect the specific gravity, we may form an approximate idea of the proteids from a knowledge of the specific gravity and the percentage of fat. We may thus determine whether they are greatly in excess or very low, which, after all, is the important thing. The specific gravity will then vary directly with the proportion of proteids, and inversely with the proportion of fat, *i. e.*, high proteids, high specific gravity; high fat, low specific gravity. The application of this principle will be seen by reference to the accompanying table.

WOMAN'S MILK.

	SPECIFIC GRAVITY, 70° F.	CREAM, 24 HRS.	PROTEID CALCULATED.
Average	1.031	7 per cent	1.5 per cent
Normal variations...	1.028-1.029	8 per cent-12 per cent	Normal (rich milk)
Normal variations...	1.032	5 per cent-6 per cent	Normal (fair milk)
Abnormal variations.	Low (below 1.028)	High (above 10 per cent)	Normal (or slightly be- low)
Abnormal variations.	Low (below 1.028)	Low (below 5 per cent)	Very low (very poor milk)
Abnormal variations.	High (above 1.032)	High	Very high (very rich milk)
Abnormal variations.	High (above 1.032)	Low	Normal (or nearly so)

Any specimen taken for examination should be either the middle portion of the milk, i.e., after nursing two or three minutes—or, better, the entire quantity from one breast, since the composition of the milk will differ very much according to the time when it is drawn. The first milk is slightly richer in proteids and much poorer in fat.

The “pioscope” is an instrument used for testing breast milk. It is composed of two disks, the lower one of hard rubber, the upper one of glass. The latter is divided into sections labeled and colored to represent milk of different qualities, normal, very fat, cream, very poor, poor, less fat. The milk immediately after being drawn from the breast is placed in a small depression in the center of the rubber disc. The glass is then placed over it and as the milk is spread out, the quality of the milk can be read by comparing with the sections on the glass disc.

The *problems* to be met in the *supervision of breast feeding* are: 1. The increase of a too small supply. 2. Changing the character of the milk, (a) decreasing the proteids, (b) increasing the fat, (c) decreasing the fat. 3. To make serviceable nipples out of flat and depressed ones. 4. To supply an artificial or adjuvant food in case of a good but too small supply from the breast. 5. To continue nursing should there be a suppurating mastitis, and retain the integrity of the gland after a subsidence of the inflammation.

While, as a general rule, it may be stated the ideal food is a healthy breast milk, this is not always the case, for not infrequently a mother has an abundant supply but secretes a milk which is unsuited to the needs of her own baby. These cases, however, are the exception, and it is infrequent that we find an unsuitable breast milk which cannot be changed by suitable remedial measures, hence I cannot refrain from saying a word against the unnatural mother who refuses to nurse her infant from purely selfish reasons, that she may have more time for society or pleasure. No physician should be a party to this or encourage it in any way, unless it can be plainly shown by most careful examination that the milk is unsuited and beyond remedial measures. The very fact that artificially fed infants show so much greater rate of mortality than the breast-fed infant, is sufficient reason for advocating breast feeding.

While it may be a fact in the larger centers of population that mothers are unfeeling and unnatural enough to allow social obligations to interfere with nursing their babies, we believe that in the South and West this is seldom seen. There are undoubtedly cases where weaning must be decided upon, in which the child does not gain, or there is continual disagreement of the milk in spite of efforts to change the constituents. I have seen a number of cases in which the necessity for weaning has arisen early from insurmountable reasons. These have been enough to impress on me the folly of voluntarily surrendering a good breast milk supply for the uncertainties of artificial feeding.

It is entirely possible to combine the food elements present in milk of the lower animals in the exact chemical proportions as in mother's milk, but there is lacking that fine adjustment of digestibility found in the milk of the mother.

The following analyses are given of colostrum:

	<i>Winslow</i>	<i>Pfeiffer</i>
Fat	4.00	2.04
Sugar	1.5	3.74
Proteids	14.8	5.71
Salts	1.00	0.25
Water	78.7	88.23
	<hr/>	<hr/>
	100.00	100.00

Colostrum is more yellow in color than milk, does not coagulate readily except on boiling and contains, in addition to the small regular size fat globules, the large granular colostrum corpuscles. These may persist in the milk until after the second week, but usually are not present after the tenth day. They recur during lactation, during menstruation and under the stress of great mental excitement, fear, anger, sorrow, sexual excitement, etc. When present abnormally, similar symptoms appear to those which occur soon after birth, diarrhea, and frequently vomiting. Compared with milk, colostrum has a higher percentage of proteids and less sugar and fat.

Besides this change which occurs, the milk may be influenced by any temporary illness of the mother, as influenza or grippe; or any serious or prolonged illness, as typhoid fever, which would interrupt the nursing entirely.

Certain drugs are said to be excreted in breast milk; as opium, belladonna, cascara, mercury, iodides, bromides and salicylates. The elimination of drugs in the milk is not sufficiently certain or exact to employ this method of medication in infants, nor enough to remove the child from the breast for, if any of these drugs were indicated in the mother.

The following case illustrates colostrum disagreement:

A mother began to menstruate four weeks after her delivery. Immediately her baby, which was doing well previously, began vomiting and purging. The second month the menstruation recurred with similar symptoms in the baby. I was called to see the child at this time and an examination of the breast milk showed it to be heavily loaded with colostrum corpuscles. The child was ill for several days, was weaned, and for one year was a constant care and anxiety, because of the difficulty of finding a suitable food or milk modification for it.

There may be ample supply of good milk, but the absence of a serviceable nipple may prevent the child's obtaining it. This may be often seen, and it should be a routine practice to make as early an examination of the breasts and nipples of a pregnant woman as possible, especially in primipara, in order to give instructions in the massage of flat and depressed nipples. By massage and training a very serviceable nipple can be made from an unpromising one if the treatment is begun early enough. The wearing of tight corsets or clothing should be advised against during pregnancy, but especially in the presence of flat or depressed nipples. A careful inquiry should also be made of multipara in regard to their lactation history, as having a bearing on the possibility of nursing the new baby.

The nipples during the last two months of pregnancy, should be prepared for nursing after the method of Mabbott. Each evening a small bit of lanolin is rubbed into the nipple and surrounding areola, and as part of the toilet in the morning, with a coarse wash cloth and soap they are washed, dried and dusted with talcum.

A stationary weight, or a loss after the second week; vomiting, not simply a slight regurgitation; colic; continuous crying; diarrhea, with green movements, containing curds and mucus,

should be an indication for a close investigation of the breast milk, the frequency and time of nursing and the daily routine of the baby's life.

A too high percentage of proteids is evidenced by colic, crying, with a doubling up of the legs, tense abdomen, green stools containing mucus and curds. This very often occurs during the puerperium, but as soon as the mother gets up and is able to take the proper exercise, the increased proportion of proteids is generally decreased. Should this relatively high percentage of proteids with low percentage of fat persist, and the plentiful supply keep up, much help can be had from pumping or milking out the foremilk from the breast, the child being allowed to nurse only the middlemilk and strippings. Taking the child from the breast before it has finished nursing and giving it a small quantity of barley water, previously dextrinized, from a bottle, will often relieve the colic, lessen the diarrhea and make the curds smaller.

Too much fat, which I have met but a few times, causes vomiting and diarrhea, with few or no curds in the movements. If too much fat is present there may be found in the stools small, round masses which resemble casein curds very much, but are smooth and soft and not so white as casein curds.

A too small milk supply calls for active treatment. It is evidenced by a stationary weight or a loss in the weight of the infant; crying within a few minutes after leaving the breast and sucking vigorously on its fists after nursing. If the deficiency in supply is the only fault, it may frequently be increased by such galactagogues as nutrolactis or somatose, free drinking of milk, cocoa or chocolate and the cereal gruels.

These *gruels* may be made of oatmeal, barley or cornmeal. After thorough cooking for several hours, they are ready to serve, enough milk being added so they can be drank from a cup or eaten with a spoon. No article of diet so stimulates the function of the gland as cow's milk, and in connection with the cereals excellent results are seen.

Alcoholic beverages are to be avoided, as they encourage the secretion of a milk with a deficiency in its life-giving properties and an increase in the watery element.

If these measures do not correct the difficulty, the child should be kept on a modified cow's milk, of suitable formula, in addition to the nursing, giving at first 1 or 2 drachms to an infant of four weeks immediately after a breast feeding, gradually increasing the amount as indicated. This will generally suffice to obtain a satisfactory gain in its weight.

With a good milk supply, regularity of nursing, infrequent or no night nursing, a child will generally do well; a good supply with a disregard of these requisites will result, perhaps, in serious digestive derangements. Should a combined breast and artificial feeding be necessary, the one or two night feedings should be breast milk if for no other reason than the convenience to the parents. The only objection to this is the possibility of the mother falling asleep and allowing the child to lie with the nipple in its mouth for several hours at a time.

To increase the quantity of the milk, give more nutritious diet, more milk and cereal gruels.

To increase fat, give milk and meat.

To decrease fat, give less meat and milk and increase the water.

To increase the proteids, give more meat and eggs; lessen exercise.

To decrease proteids, increase exercise to point of fatigue and decrease meat.

Wet Nurse.—In premature infants with no maternal milk supply, or where sudden weaning from any cause becomes imperative, a wet nurse should be obtained.

The selection of a wet nurse is beset with many difficulties. The following should be taken under consideration: the age of the wet nurse, the age and weight of her infant, the nurse's general health, development and general surroundings. A careful physical examination should be made of both the nurse and her baby and tuberculosis and syphilis positively excluded. If there is time her breast milk should be carefully analyzed before she is engaged. The diet of the nurse should not vary greatly from what she has been accustomed to, as lack of exercise may change the character of her milk entirely.

Weaning.—It is well to begin weaning an infant at about 8 months of age; with at first one feeding a day, then two, gradually displacing the nursings by an additional bottle feeding, until at the end of the first year entire weaning has been accomplished.

The weaning may be accomplished suddenly, but frequently not without considerable gastric and intestinal disturbance being caused in the child.

Combined Feeding.—If it is apparent that a child is not gaining rapidly while nursed exclusively, by giving one or two artificial feedings a day, of modified cow's milk, very good results can frequently be obtained.

As when entire artificial feeding is begun, so when only partially fed, a much weaker formula should be given than necessary for the child's needs to begin with, and gradually increase the strength of the formula until one is reached upon which it will be contented, and will gain in weight.

It is frequently a very good plan when a child is a few weeks old to give it one bottle a day, in order to accustom it to an artificial food, and also to enable the mother to have a few extra hours of recreation, occasionally, if the demand arises.

Artificial or Substitute Feeding.—A mother being unable to nurse her infant, and a wet nurse is nowhere to be found, the child must be nourished artificially. Infants can not be fed by rule; each is a law unto itself; what will agree with one will disagree with another. Adapted or modified cow's milk offers the best results, but the first principle to be learned is that one must think in percentages, not in standard formulæ which can be given to this or that baby of a certain age. The minimum food requirements must be combined in a scientific adaptation, and the proper adjustment made later, sufficient to cause regular gains in weight. With careful daily weighing, and inquiry into the condition of the digestion, a gaining formula will soon be decided upon.

One Cow's Milk.—It has long since become an accepted fact that the milk from one cow should not be used for infant feeding. Mixed milk from a herd is more uniform in composition,

and there is less likelihood of changes occurring in the milk as the result of fright, or disease being harmful because of its dilution with the herd's milk.

Cow's Milk.—Because of the universal supply of cow's milk, and the fact that it contains the same general constituents of and can be modified to nearly resemble mother's milk, it is the best substitute for normal mother's milk, when artificial feeding is necessary. A comparative analysis of mother's and cow's milk is here given:

	<i>Mother's Milk</i>	<i>Cow's Milk</i>
Fat	4.0	4.0
Sugar	7.0	4.0
Proteids	1.5	3.5 to 4.0

No food product is so capable of contamination as milk, or as little average intelligence used as in its production and care. How common is the saying, especially in cities, when the diet of a sick child is under discussion: "Take it to the country where you know good milk can be obtained." It is a fact that but few people in the country, unless in the scientific dairy business, know the first principles of the production and handling of milk.

Certified Milk.—Realizing this fact, and that pure milk, especially for infants, sick children and invalids, was a necessity, Dr. Henry L. Coit of Newark, N. J., in 1894, suggested the plan of securing a dairyman who would produce milk and handle it in a scientific manner, according to the rules of a financially disinterested commission of physicians.

This was done, and the product of this dairy was termed "Certified Milk," the term being registered at the Patent Office in Washington by the dairyman, Mr. Stephen Francisco, and Dr. Coit. They have very generously allowed the use of the term by similar commissions, and a number of the larger cities have such a supply. In 1907, at Atlantic City, was formed the American Association of Medical Milk Commissions, with Dr. Coit as its first president, its membership composed of the members of milk commissions throughout the country, and dairy scientists in this country and abroad. This association has done much

toward systematizing and making more uniform the rules and standards and working methods of commissions and populariz-



Fig. 29.—Where cleanliness is a religion. Certified Dairy No. 2, Louisville

ing this plan of obtaining at least one pure supply of milk in the larger centers of population.

Kentucky has a law which limits the use of the term "Certified Milk" to a milk commission regularly appointed by a county medical society. This effectually prevents the use of the term by a dairyman, for commercial reasons, without producing the milk according to the requirements of a commission. New York

and New Jersey also have such a law. The Kentucky law is as follows:

An act for preventing the manufacturing and sale of adulterated or mis-



Fig 29a —Immaculate milking conditions. Certified Dairy No. 2¹

branded foods, drugs, medicines and liquors, and providing penalties for violations thereof.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

SECTION 1. That it shall be unlawful for any person, persons, firm or corporation within this State to manufacture for sale, produce for sale, expose for sale, have in his or their possession for sale or to sell any article

¹ Figs. 29 and 29a from "Certified Milk Production" by the author, published in *The Milk Trade Journal*, June, 1918.

of food or drug which is adulterated or misbranded within the meaning of this act; and any person or persons, firm or corporation who shall manufacture for sale, expose for sale, have in his or their possession for sale or sell any article of food or drug which is adulterated or misbranded within the meaning of this act, shall be fined not less than ten dollars nor more than one hundred dollars, or be imprisoned not to exceed fifty days or both such fine and imprisonment. Provided, that no article of food or drug shall be deemed misbranded or adulterated within the provisions of this act when intended for shipment to any other State or country, when such article is not adulterated or misbranded in conflict with the laws of the United States; but if said article shall be in fact sold or offered for sale for domestic use or consumption within this State, then this provision shall not exempt said article from the operations of any of the other provisions of this act.

SECTION 2. That the term food, as used in this act, shall include every article used for or entering into the composition of food or drink for men or domestic animals, including all liquors.

SECTION 3. For the purpose of this act, an article of food shall be deemed misbranded:

First. If the package or label shall bear any statement purporting to name any ingredient or substance as not being contained in such article, which statement shall not be true in any part; or any statement purporting to name the substance of which such article is made, which statement shall not give fully the name or names of all substances contained in any measurable quantity.

Second. If it is labeled or branded in imitation of or sold under the name of another article, or is an imitation either in package or label of another substance of a previously established name; or if it be labeled or branded so as to deceive or mislead the purchaser or consumer with respect to where the article was made or as to its true nature and substance or as to any identifying term whatsoever whereby the purchaser or consumer might suppose the article to possess any property or degree of purity or quality which the article does not possess.

Third. If in the case of certified milk, it be sold as or labeled "certified milk," and it has not been so certified under the rules and regulations by any county medical society, or if when so certified, it is not up to that degree of purity and quality necessary for infant feeding.

In a local Louisville court, conviction and fine was obtained in 1908 of a dairyman, under the State Pure Food Laws, who had sold milk labeled "Certified Milk," which had not been certified to by the Jefferson County Milk Commission, the prosecution being because of misbranding and a tendency to deceive the public.

Certified Milk is clean, cold milk which has been produced in a scientific manner, under rules laid down by a Medical Milk Commission, from a tuberculin tested, healthy herd, in properly constructed, clean barns, by clean, healthy milkers, in sterile vessels, cooled, and bottled immediately in sterilized bottles, iced



Fig. 30—Certified milk bottle. Stand and cap, protecting mouth of bottle.



Fig. 31—Certified milk in special glasses for lunch counter trade.

and kept cold until delivered. Milk cannot be produced in this manner and sell for the same price as market milk, produced in dirty surroundings and delivered to a city distributor in ten-gallon cans and then bottled or peddled from these cans from open measures. The bacterial content of Certified Milk can easily be kept below the limit of 10,000 per cc. while market milk is rarely found with a count of less than 100,000 per cc.¹

Excretion of Foreign Matter in Milk.—Inflammatory conditions of the udder may result in contamination of the milk by the presence of pus and microorganisms from the affected parts. Certain foods may cause a decided odor as well as taste to cow's

¹ The Methods and Standards for the Production and Distribution of "Certified Milk" were adopted by the American Milk Commissions, at the meeting over which the author had the honor of presiding, held in Louisville, May 1st, 1912. So important are these rules they are reproduced in full in the Appendix.

milk, as when they are fed on garlic or lupines, the latter imparting a bitter taste to the milk.

Changes in Milk Produced by Bacteria and Other Microorganisms.—The commoner and well-known changes which occur in milk as the result of the action of bacteria and other microorganisms are as follows: The souring of milk, with curdling, due to action of the lactic acid bacteria; the putrefaction of milk, with production of various odors; the coloring of milk; the production of ropy milk.

The fermentation caused by the *lactic acid bacteria* in milk, kept at ordinary temperature, is well known. The result of this fermentation is souring and curdling of the milk, and all other bacterial changes are temporarily stopped. As a result of the infection of the milk by other organisms, abnormal fermentations take place, causing changes in the color, odor and taste of the milk. A blue discoloration of the milk is due to its contamination by bacteria, known as the *Bacillus Cyanogenes*, and they exert their peculiar effect only after the milk has become sour. Others describe a red milk, but this can usually be traced to a cow with diseased or injured udders. Slimy or ropy milk is due to the organism known as *B. lactis viscosus*, and is found in the water supply of the place.

The first few drops of milk from a healthy udder may contain a few bacteria, but the rest of the milk direct from the udder should be sterile. Milk is one of the best culture mediums and it may readily become contaminated from the air, the cow's skin, hair and udder, the milker's hands or clothes, or the utensils with which the milk comes in contact. A *clean, cold* milk, from a healthy herd, will remain safe until consumed if handled properly. The chief aim being to keep dirt out of the milk, and as much comes from the cow's skin and tail, the buckets which have a small opening at the top and more at the side than in the middle, allow the milk to be drawn into it easily and prevent the dirt and hair dropping into it.

If milk properly produced and handled has been cooled directly after milking to 45° F., and kept at this temperature, the bacteria per cubic centimeter (20 drops) should not exceed 10,000, while ordinary market milk will contain from 500,000

to several million per cubic centimeter. Clean milk, cooled and kept cold, will not have a great increase in bacterial content at the end of several days, and it can be found sweet at the end of



Fig. 32.—Gurler milk pail. Gauze fits over opening with layer of cotton between.



Fig. 33.—Hooded milk pail.

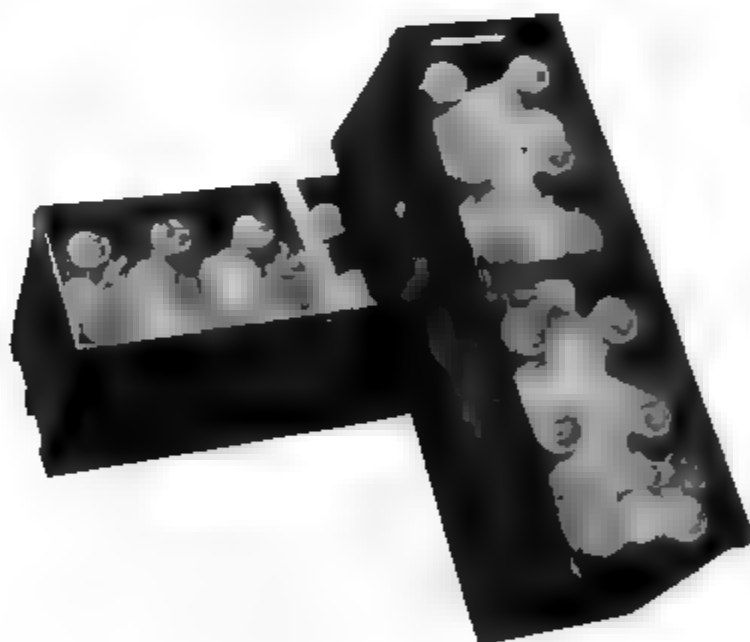


Fig. 34.—Certified milk shipping cases. Standard cap and seal on bottles.

a number of days. I have drank such milk kept in this way when 21 days old, and milk sent to the Paris Exposition in 1900 from Illinois, New Jersey and New York, was sweet at the end of 14 days. This milk had been kept cold, and was clean at the first milking. In the Summer of 1910 on a trip to Europe we used Certified Milk from Louisville and drank the last quart which was perfectly sweet sixteen days after milking.



Fig. 34a.—Felt lined box with removable zinc container, used in Kentucky milk inspection work, for collecting samples of original bottles. Larger boxes, made on the same style, are used for shipping. This box is so constructed as to maintain a temperature of from 1 to 2° C., for 24 hours.



Fig. 34b.—Box used in collecting samples of bulk milk, water, and samples of milk from the various processes in the dairy and milk depot. Made of wood and felt lining and an inside copper tank. The copper tank contains a wire basket in several partitions, for holding 20 ordinary test tubes. On either side of the basket is a copper lid, and the ice is put under the copper lid. The ends of the tubes extend into the iced water. The wrapped, sterile pipettes are shown, and as each pipette is used, it is put on the opposite side of the box. The copper tank can be removed and sterilized.

NOTE.—Boxes described in Figs. 34a and 34b designed and used in the milk inspection work of the Food and Drug Department, Kentucky Agricultural Experiment Station. Photograph furnished by R. M. Allen, Head of Department.

The number of bacteria in milk free from preservatives is a direct indication of the cleanliness employed at the dairy in the production of the milk, the temperature at which it has been kept and its age.

Standards of bacterial contents are being adopted in many of the large cities. Certified milk has a limiting standard of 10,000 per cc.; inspected milk 100,000 per cc. (50,000 per cc. in Louisville), and several cities for market milk 500,000. Hence the bacterial count of milk is a most important procedure.

Market Milk.—Cow's milk, to be fit for consumption by infants and children should answer the following requirements: It should be clean; from a healthy herd which has been tuberculin tested; cooled immediately after milking; bottled at once and sealed; contain no preservatives; be of standard and definite chemical analysis and kept cold until delivered to the consumer.

Ordinary city market milk is not fit for infant feeding. It is shipped to the city in large cans, hauled through the streets in an uncovered wagon, to the central distributing station, there bottled (usually in unclean bottles) and distributed, no ice being ever near it. Some bottle the milk in delivery wagons from large cans, the bottles being dusty and unsterilized. This milk contains many million bacteria, and rapidly sours in warm weather, even if kept on ice.

Milk from cows kept on distillery waste or slop, or brewers' grain or ensilage in any state of putrefaction or fermentation, is unfit for consumption. Cows so fed suffer from a diarrhea, and the stables housing them are filthy beyond description. Milk produced in such barns contains myriads of bacteria.

Tuberculosis.—Since Koch advanced his dictum in 1901 that bovine tuberculosis was not transmissible to man, scientists of the world have been at work to disprove it. This has unquestionably been done. Undoubted cases of direct transmission have been recorded by Jensen,¹ a few of which may be mentioned:

1. The 17-year-old daughter of Prof. Gosse died of abdominal tuberculosis after drinking milk from cows affected with udder tuberculosis. Other sources of infection could not be discovered.

¹ Jensen's Milk Hygiene.

2. Oliver's observation concerns one of the best-proved cases of transmission by milk. In a boarding school 12 young girls became ill with signs of intestinal tuberculosis and five of them died. All came from healthy families and no source of infection was found but one cow which supplied milk for the school, and was shown to be affected with tuberculosis of the udder.

3. Demme has reported the following: In the children's hospital, Bern, four children died of intestinal and mesenteric glandular tuberculosis. He was able to exclude all other sources of infection and to prove that the milk came from tuberculous cows.

4. Hills tells of a 21-months-old child that was affected with intestinal tuberculosis three months after making an eight-day visit to an uncle where it had drank the milk of a cow having advanced tuberculosis. The child died of tuberculosis. Other sources of infection were excluded and another child fed only with sterilized milk remained healthy.

5. Ernst reports that three children of the same family died of tuberculosis after drinking milk from a cow that died of general tuberculosis with udder involvement.

Mohler¹ states that:

The finding of the bovine type of tubercle bacillus in human lesions is the most direct and positive proof that tuberculosis of cattle is responsible for a certain amount of tuberculosis in the human family. Numerous experiments with this object in view have already proven this fact. Thus the German Commission on Tuberculosis examined 56 different cultures of tubercle bacilli of human origin and found six which were more virulent than is usual for human tubercle bacilli, causing marked lesions of tuberculosis in the cattle inoculated with them, and making over 10 per cent of the cases tested that were affected with a form of tuberculosis which, by Koch's own method, must be classified as of bovine origin. The bacilli, with the exception of a single group, were all derived from the bodies of children under seven years of age, being taken from tubercular ulcers in the intestines, the mesenteric glands or from the lungs.

In a similar series of tests conducted by the British Royal Commission on Tuberculosis, 60 cases of the disease in the human were tested, with the result that 14 cases were claimed by this commission to have been infected from bovine sources. Ravenel reports that of five cases of tuberculosis in children two received

¹ Bulletin 14, Hygienic Laboratory.

their infection from cattle. Theobald Smith has also reported on one culture of the bovine tubercle bacillus obtained from the mesenteric glands of a child out of five cases examined, and, according to a recent paper by Goodale, Smith has recently been at work on seven other cultures from different children, four of which conformed to his idea of tubercle bacilli emanating from cattle. Of four cases of generalized tuberculosis in children examined in the Biochemic Division of the Bureau of Animal Industry, two were found to be affected with very viru-



Fig. 35.—A sample of the unsuspected but dangerous tubercular cow Rejected by the veterinarian after test

lent organisms, which warranted the conclusion that such children had been infected from a bovine source. The Pathological Division of the same Bureau has likewise, out of the nine cases of infantile tuberculosis examined, obtained two cultures of tubercle bacilli that could not be differentiated from bovine cultures. In Europe so many similar instances of bovine tubercle bacilli having been recovered from human tissues are on record that it appears entirely proven that man is susceptible to tuberculosis caused by animal infections, and while the proportion of such cases cannot be decided with even approximate accuracy, it is nevertheless incumbent upon us to recommend such measures as will guard against these sources of danger when enforced.

Tuberculosis is markedly prevalent throughout the United States in dairy cattle. It is estimated that in certain sections it affects from 20 to 60 per cent of the members of all herds. In Washington 16.9 per cent of 1538 cattle tested reacted to the test. It is conceded by all that local tuberculosis in the udder will result in contamination of the milk with tubercle bacilli, and that in other forms of bovine tuberculosis, as of the intestine and lungs, great quantities of bacilli are excreted by the discharges which may contaminate the milk. It has been found, for instance, that 70 per cent of all milk examined in Washington, D. C., contained dirt, and microscopic examination showed it to be fecal in character, hence the frequency of contamination by tubercle bacilli.

Tuberculin Test.—The tuberculin used in this test is the sterilized and filtered glycerine extract of cultures of tubercle bacilli. In the hands of competent men it is practically an infallible test, and a cow which reacts to the test should be slaughtered at once. This should be under State indemnification, for without State aid the disease will not be eradicated.

If the injected animal is normal the result of the tuberculin injection will be negative, that is, she will not show a rise in temperature.

The "test" is applied as follows: The temperature of the cow is taken in the rectum at two-hour intervals for 12 hours and the variations noted. That night about 9 p. m. the tuberculin is injected hypodermatically in a shaved portion of the skin of the hip. The following day the temperatures are taken again and recorded, as nearly as possible every two hours, and continued for 20 hours.

In the markedly tubercular a small dose of the tuberculin may show no reaction. A tolerance is shown for the tuberculin for six weeks after an injection.

A reaction may be found in advanced pregnancy, during the œstrum and in concurrent diseases, as inflammations of the lungs, intestines or uterus; or when a sudden change is made in the feeding during the test.

In reading the temperatures taken after the test, a rise of 2° F. is not noted. It should go above 103.8° F. Cows reacting

should be slaughtered at once and examined by veterinary experts capable of detecting minute as well as gross lesions.

Salmon concludes as follows, regarding the tuberculin test:

1. That the tuberculin test is a wonderfully accurate method of determining whether an animal is affected with tuberculosis.

2. That by the use of tuberculin the animals diseased with tuberculosis may be detected and removed from the herd, thereby eradicating the disease.

3. That tuberculin has no injurious effect upon healthy cattle.

4. That the comparatively small number of cattle which have aborted, suffered in health or fallen off in condition after the tuberculin test, were either diseased before the test was made or were affected by some cause other than the tuberculin.

A cow may be dangerously tubercular as shown by Schroeder¹ long before she shows clinical evidences of tuberculosis. She may not cough, may eat well, calve, and in every way appear normal, yet be excreting millions of bacilli before the presence of tuberculosis is determined by the tuberculin test.

Epidemics Due to Milk.—Specific organisms may contaminate milk and cause epidemics among its users. Typhoid fever is more frequently spread through the medium of water, next by milk. Jensen records 90 epidemics of typhoid in Copenhagen, from 1878 to 1896. I have traced one in Louisville where there were 54 cases in a small territory, 44 of whom used milk from one dairy. In one family only one person used unboiled milk and she contracted typhoid. Typhoid bacilli were demonstrated by the late Dr. Louis Vissman in the water used on this dairyman's place for can washing. Diphtheria may be milk borne, also. Smithbank and Newman² record 100 cases in Ashtabula, Ohio, affected with diphtheria in 1894. Milk was delivered to all by the same dairyman. A farm hand had a sore throat, and he had assisted at the work of the dairy while so suffering.

Scarlet fever epidemics have undoubtedly been traced to milk. Touching this point of epidemics due to milk, Busey and Kober gave a summary of the epidemics compiled by them as follows:³

¹ Bulletin 114, U. S. B. A. I.

² Jensen.

³ Hygienic Laboratory Bulletin 14, Marine Hospital Service.

TYPHOID FEVER EPIDEMICS.

Mr. E. Hart tabulated 50 epidemics of typhoid fever and we have collected 88, making a total of 138 epidemics traceable to a specific pollution of the milk, the main facts of which are presented in a subjoined table. In 109 instances there is evidence of the disease having prevailed at the farm or dairy. In 54 epidemics the poison reached the milk by soakage of the germs into the well water with which the utensils were washed and in 13 of these instances the intentional dilution with polluted water is admitted. In 6 instances the infection is attributed to the cows drinking or wading in sewage-polluted water. In three instances the infection was spread in ice cream prepared in infected premises. In 21 instances the dairy employees also acted as nurses. In 6 instances the patients while suffering from a mild attack of enteric fever, or during the first week or ten days of their illness continued at work and those of us who are familiar with the personal habits of the average dairy boy will have no difficulty in surmising the manner of direct digital infection. In one instance the milk tins were washed with the same dishcloth used among the fever patients. In one instance the disease was attributed to an abscess of the udder, in another to a teat eruption, and in one to a febrile disorder in the cows. Four were creamery cases. In one the milk had been kept in the sick room.

SCARLET FEVER EPIDEMICS.

Mr. Hart collected 15 epidemics of milk scarlatina, and we have tabulated 59, making a total of 74 epidemics spread through the medium of the milk supply, the details of which will be found in Table No. II.

In 41 instances the disease prevailed either at the milk farm or dairy. In 6 instances persons connected with the dairy either lodged in or had visited infected houses. In one the milkman had taken his can into an infected house. In 20 instances the infection was attributed to disease among the milch cows; in 4 of these the puerperal condition of the animal is blamed. In 9 instances disease of the udder or teats was found. In one instance the veterinarian diagnosed a case of bovine tuberculosis. In 6 instances there was loss of hair and casting of the skin by the animal. In No. 68 the cattle were found to be suffering more or less from febrile disturbance. In 10 instances the infection was doubtless conveyed by persons connected with the milk business, while suffering or recovering from an attack of the disease and in at least 8 cases by persons who also acted as nurses. In three instances the milk had been kept in the cottage close to the sick room. In one the cows were milked into an open tin can which was carried across an open yard past an infected house, and in one the milkman had wiped his cans with white flannel cloths (presumably infected) which had been left in his barn by a peddler. Two appear to have been instances of mixed infection of scarlet fever and diphtheria.

DIPHTHERIA EPIDEMICS.

Mr. Hart collected 7 epidemics of milk diphtheria and we have added 21 more. In 10 of these 28 instances diphtheria existed at the farm or dairy, and in 10 instances the disease is attributed directly to the cows having garget, chapped and ulcerative affections of the teats and udder, while in one the cows were apparently healthy but the calves had diarrhea. In one case one of the dairymaids suffered from a sore throat of an erysipelatous character, and in one the patient continued to milk while suffering from diphtheria. In one, one of the drivers of the dairy wagons was suffering from a sore throat.

Care of Milk in the Home.—But little care is taken of milk in the home of the consumer. Many homes do not have ice either in winter or summer and it is entirely impossible to keep milk sweet in summer without ice.

The average time for delivery of milk in the city is from 4.30 a. m. to 6 a. m. It is left upon the door step or shelf by the kitchen door, frequently in summer in the sun, from the time it rises until the servants arrive, when the bottles may or may not be put on ice at once. Among the poorer classes the milkman rings a bell from his wagon and the customer comes out with an open bucket and the milk is drawn from a can which has been hauled around the city, in the sun, and without a protecting cover, this milk having never been aerated or cooled.

Milk should not be kept in uncovered vessels or in a refrigerator with vegetables, especially those which give off an odor.

Among the well-to-do the use of a thermal bottle, an appliance for keeping hot things hot and cold things cold, has been suggested as a labor saver to keep the baby's milk warm at night. By keeping milk warm for several hours at a temperature of 95° F. to 100° F., bacterial growth is very rapid and the milk entirely unfit for use. The sale of these bottles for such purposes should be prohibited by law.

Recently a breast-fed baby seven months old, under my observation, had been stationary in weight for several weeks, and the last week had lost in weight. It was decided to supplement the breast feeding by two bottles of modified milk a day. This was done, with a slight gain in weight but a report of thin green stools. Inquiry developed the fact that

one feeding at night and the first morning feeding were prepared and kept warm in a "thermos" bottle. I had some milk prepared as usual the next night and the bottle was not opened until the following morning, when some of it was plated, and as a control, some of the Certified milk delivered the same day and from which the sample in the "thermos" was prepared, also plated.

The Certified milk showed a count of 3400 bacteria per cc., and the milk in the thermos bottle 1,400,000. The child improved at once upon discontinuing the use of the thermos bottle.

MORBIDITY AND MORTALITY STATISTICS AS INFLUENCED BY MILK.¹

It has been estimated that 23 gallons of milk are purchased for each person in the United States each year. This very great consumption of one commodity must have some influence on the population, for good or bad. As children under one year of age are the chief users of milk, it must be to statistics we must look for an answer to the question: Does milk have any influence upon mortality statistics?

The United States Census Office reports a population of 33,757,811. There were 545,533 deaths of all ages and 105,553 deaths in infants under one year of age.

Diarrhea and enteritis caused the death of 39,399 infants in their first year of life. These figures show a large proportion of the total deaths are in infants under one year of age, and a large proportion of these deaths are due to digestive disorders. Eager points out that a child consumes 500 quarts of milk during its first year, and practically to the exclusion of other articles of diet, hence it is safe to conclude that milk is the cause of the digestive disturbances which result fatally. It is shown also that the mortality in artificially-fed children is far greater than in children nursed at the breast. Newsholme² states that, taking the whole first year of life, the number of

¹ Eager: Bulletin 14, Hygienic Laboratory.

² Loc. cit.

deaths from epidemic diarrhea among breast-fed babies is not more than *one-tenth* the number among artificially-fed infants.

Epidemics and tuberculosis from a milk source have already been referred to. It can readily be inferred that an exhaustive study of the milk question as it relates to infant mortality is amply justified.

Sterilization and Pasteurization.—Milk brought to the temperature of 212° F. for 15 minutes is sterilized; when brought to 167° F. to 170° F. for 20 minutes it is Pasteurized, the dif-



Fig. 36.—Ossile Pasteurizer.

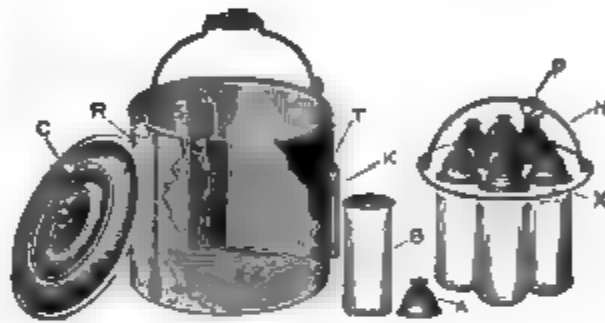


Fig. 37.—Hygeia Pasteurizer.

ference being entirely the amount of the heat used. Soxhlet, in 1886, advised the heating of milk for infant feeding and described an apparatus for carrying this out in the home.

When it is impossible to obtain a milk for infant feeding which is known to be clean and cold, or the milk contains a quantity of sediment, and sours easily, it is decidedly best to submit it before feeding to sterilization or Pasteurization. Pasteurized milk means "heated milk," and does not necessarily mean "clean, good or pure milk."

Both of these processes destroy bacteria, but do not entirely destroy the spores. After heating, unless the milk is kept below 50° F. these spores germinate, and a new strain of bacteria are produced which multiply rapidly. The germs most frequently found in milk are the tubercle bacillus, typhoid bacillus, Klebs-Loeffler bacillus, the pyogenic cocci and the virus of foot

and mouth disease of cattle. These are all killed at even a lower temperature than 107° F., if maintained long enough.

The chief difficulty in wholesale Pasteurization of milk is its being heated in bulk and put in unsterilized containers, either bottles or cans. To be entirely effective it should be first bottled, under as strictly cleanly auspices as possible, then Pasteurized, cooled immediately, and kept cold until consumed. Unfortunately the Pasteurization or sterilization of milk lulls one into a false feeling of security in regard to it. The general belief is that the milk so treated will keep indefinitely and without ice, whereas if such a sample of Pasteurized milk is plated it will be found to contain many thousand bacteria. It has been suggested by the New York City Milk Committee's report to the Mayor, that when Pasteurized milk is found to contain 50,000 bacteria to the cubic centimeter it should be destroyed.

The result of a number of counts made of a commercially-Pasteurized milk in Louisville showed an average of 200,000 bacteria per cubic centimeter.

Effect of Heat.—Owing to the lactic acid bacteria being destroyed by heat, milk so treated does not sour, but slowly putrefies. The growth of the putrefying bacteria in raw milk is inhibited by the lactic acid bacteria. The effect of heat upon milk depends upon the degree of heat. It to some extent coagulates the albumin and renders the milk less coagulable by rennet. The exact change which takes place in milk after heating is not known, and there is not sufficient clinical data at hand to positively prove that heated milk is insufficient for the nutritional needs of the child. Milk of Certified grade is best for an infant. Market milk unless it has been Pasteurized is unfit for artificial feeding and Pasteurization is preferable to sterilization.

Composition of Milk.—The milk from cows of different breeds contains the same ingredients, but in different proportions, as shown by the following table, the results of quantitative analysis.¹ These proportions vary according to the breed of the cow, condition of the cow and the time and method of milking.

¹ Winslow from Gordon's Tables.

	DURHAM OR SHORT- HORN	DEVON	AYR- SHIRE	HOLSTEIN FRIESIAN	JERSEY	BROWN SWISS	COM'ON NATIVE
Fat	4.04	4.00	3.89	3.2	5.22	4.0	3.69
Sugar	4.34	4.32	4.41	4.33	4.84	4.30	4.35
Proteid	4.17	4.04	4.01	3.99	3.58	4.00	4.09
Mineral matter...	0.73	0.73	0.73	0.74	0.73	0.76	0.76

Leach¹ gives the following analyses showing the composition of milk of the human and a number of different animals:

NUMBER OF ANALYSES	KIND OF MILK	SPECIFIC GRAVITY	WATER	CASEIN	ALBU- MIN	TOTAL PRO- TEIDS	FAT	MILK SUGAR	ASH
800	Cow's milk.								
	Minimum ...	1.0264	80.32	1.79	0.25	2.07	1.67	2.11	0.35
	Maximum ...	1.0370	90.32	6.29	1.44	6.40	6.47	6.12	1.21
	Mean	1.0315	87.27	3.02	0.53	3.55	3.64	4.88	0.71
200	Human milk:								
	Minimum ...	1.027	81.09	0.18	0.32	0.69	1.43	3.88	0.12
	Maximum ...	1.032	91.40	1.96	2.36	4.70	6.83	8.34	1.90
	Mean	—	87.41	1.03	1.26	2.29	3.78	6.21	0.31
200	Goat's milk:								
	Minimum ...	1.0280	82.02	2.44	0.78	—	3.10	3.26	0.39
	Maximum ..	1.0360	90.16	3.94	2.01	—	7.55	5.77	1.06
	Mean	1.0305	85.71	3.20	1.09	4.29	4.78	4.46	0.76
32	Ewe's milk:								
	Minimum ...	1.0298	74.47	3.59	0.83	—	2.81	2.76	0.13
	Maximum ...	1.0385	87.02	5.69	1.77	—	9.80	7.95	1.72
	Mean	1.0341	80.82	4.97	1.55	6.52	6.86	4.91	0.80
	Mare's milk:								
	Mean	1.0347	90.78	1.24	0.75	1.99	1.21	5.67	0.35
5	Ass's milk:								
	Mean	1.036	89.64	0.67	1.55	2.22	1.64	5.99	0.51

On the proteid the body must depend for its growth and development, furnishing the material for repair of waste going on in the tissues as well as for its growth.

Allen² has suggested the term proteid quotient to represent

1 Hygienic Laboratory Bulletin No. 41. Marine Hospital Service.
2 Journal American Medical Association, November 14, 1908.

the amount of proteid in quantity per pound per day needed by the child for its nourishment. He estimates this as 0.04 to 0.045 of an ounce for each pound of the baby's weight, and gives the following working figures: If the milk contains 3.5 to 4 per cent of proteid, it will be necessary to give 1 to 1.5 ounces of milk to the pound.

Proteids.—Van Slyke¹ and others have made investigations of the chemistry of milk which have been of great value.

Our knowledge regarding the nitrogen compounds of milk has been very indefinite, especially with reference to their nomenclature. Some have named as many as seven compounds, but those most frequently described are casein (caseinogen or milk casein); lactalbumin and lactoglobulin.

The most important of these is the *milk casein* which is found in combination as calcium casein, and is that portion of milk which coagulates in sour milk or as the result of acid or rennet precipitation.

All the elements necessary for nutrition are present in casein, namely, carbon, hydrogen, nitrogen, sulphur and phosphorus.

Van Slyke and Hart² have studied the action of acids, alkalis, heat and rennet on calcium casein. They found that with dilute acid there is a combination of the acid and the calcium, and the casein is set free. On the addition of further acid the casein molecule combined directly with the acid, forming a salt of the acid. The casein and the casein salts of acids are insoluble, the coagulum being casein lactate. The casein and casein salts dissolve in excess of acid.

Dilute alkaline solutions, such as the carbonates of sodium, potassium and ammonium react with free casein or its salts with acids, and form compounds that are easily soluble in water.

Heat alone at the boiling point of water does not coagulate casein in milk. The skin which forms on milk heated above 140° F. is due to the calcium casein.

The most characteristic action of any is that of rennet on milk. Calcium paracasein is coagulated, the change being a physical one only. To obtain prompt action of rennet the milk

¹ Archives of Pediatrics, July, 1905.

² Archives of Pediatrics, July, 1905.

must not be alkaline; it must not be diluted with water; must not be heated over 106° or 108° F. The rennet and the milk must be fresh, and the milk should not be boiled.

In case of milk containing 3.00 to 4.50 per cent of fat, Van Slyke¹ has suggested the following formula for calculating the amount of casein:

$$(F-3) \times 0.4 \times 2.1 = \text{per cent of casein in the milk.}$$

F. in the equation, equals the number representing the percentage of fat in the milk.

Lactalbumin is not acted on by rennet, is not coagulated by acids at ordinary temperature, and is coagulated by heat above 160° F. The ratio of calcium casein to lactalbumin is given as 3.6 to 1.

Lactoglobulin is present in very small quantities in milk.

Van Slyke gives the following figures to serve as a guide to approximately figure the amount of casein and albumin in milk, the fat content being known:

<i>Per cent of fat in normal milk</i>	<i>Per cent of casein and albumin</i>
3.0	2.90
3.5	3.10
4.0	3.30
4.5	3.50
5.0	3.65
5.5	3.80
6.0	3.95

Carbohydrates occur in milk in the form of milk sugar or lactose ($C_{12} H_{22} O_{11} H_2O$). The souring of milk occurs as the result of the action upon the lactose by the lactic acid bacteria. If the milk is kept cold these bacteria will not propagate readily.

The *fat* content of milk is found in homogeneous emulsion, composed of small droplets or globules fairly similar in size. The chief fats contained in the fat mixture of milk are olein, palmitin and stearin. The fat readily separates from the remainder of the milk, forming, on standing, a distinct deeper-colored layer above. The fat can be artificially separated by means of a centrifugal machine called the "separator." It has been claimed by some authorities that separated cream could

¹ New York Medical Journal, May 30, 1908.

Milk = 100		
Water = 87.1	Fat = 3.9	Nitrogen com- pounds
Solids = 12.9	Solids not fat = 9.0	Milk-sugar
	100.0	Ash (salts)
		<u>12.9</u>
Gases { Carbon dioxide		
{ Nitrogen		
{ Oxygen		
		<u>9.0</u>
		= 3.2 { Casein
		= 5.1 { Albumin, etc.
		= 0.7
		<u>3.2</u>

(BABCOCK)

Milk 100.0		Total solids 12.7	
Butter fat = 3.6		Fat 3.6	
Olein		Glycerides of insoluble and non-volatile acids 3.3	
Palmitin			
Stearin			
Myristin			
Butin (trace)			
Butyrin		Glycerides of soluble and volatile acids 0.3	
Caproin		—	
Caprylin (trace)		3.6	
Caprinin (trace)			
Albumin 3.00			
Casein 0.60			
Lactoglobulin		Containing nitrogen 3.8	
Galactin 0.20		.	
Fibrin (trace) —			
3.80			
Milk serum = 96.4		Solids not fat 9.1	
100.0		12.7	
Milk-sugar		4.5	
Citric acid		0.1	
Potassium oxide		0.175	
Sodium oxide		0.070	
Calcium oxide		0.140	
Magnesium oxide		0.017	
Iron oxide		0.001	
Sulphur trioxide		0.027	
Phosphoric pentoxide		0.170	
Chlorine		0.100	
.		Ash 0.7	
0.7		9.1	
Water			
		87.3	

not be reunited with the fat-free milk in the homogeneous mixtures as before separation, but this has not been entirely proven.

The *inorganic salts* contained in the milk in solution consist chiefly of lime, potash, sodium. These can be separated by incineration, and are referred to as the ash.

The tables of Van Slyke and Babcock on preceding page show the quantities of these substances just enumerated, in cow's milk.

Score Cards.—The Bureau of Animal Industry, Department of Agriculture of the Government, has suggested a method of scoring dairies, herds and milk, and samples of these are here reproduced:

(United States Department of Agriculture, Bureau of Animal Industry, Dairy Division)

Sanitary Inspection of Dairies

Owner or lessee of farm
TownState
Total No. of cows.....No. milking.....Quarts of milk produced daily
Is product sold at wholesale or retail?.....
If shipped to dealer give name and address.....
Permit No.....Date of inspection.....190..

	SCORE		REMARKS
	Perfect	Allowed	
<i>Cows.</i>			
Condition (2)	} 10	.....	.....
Health (8) .....		.....	.....
Cleanliness	5	.....	.....
Water supply	5-20	.....	.....
<i>Stables.</i>			
Construction	5	.....	.....
Cleanliness	5	.....	.....
Light	5	.....	.....
Ventilation (4)	} 7	.....	.....
Cubic space per cow (3) ..		.....	.....
Removal of manure (2) ..	} 3-25	.....	.....
Stable yard (1) .....		.....	.....
<i>Milk House.</i>			
Construction (2)	} 5	.....	.....
Equipment (3) .....		.....	.....
Cleanliness	5	.....	.....
Care and cleanliness of utensils	5	.....	.....
Water supply (Temp. °F.)	5-20	.....	.....

	SCORE		REMARKS
	Perfect	Allowed	
Milkers and Milking.			
Health of attendants.....	5	.....	.....
Cleanliness of milking...	10-15	.....	.....
Handling the Milk.			
Prompt and efficient cooling	} 10	.....	.....
(Temperature of milk °F)		.....	.....
Storing at a low temperature		.....	.....
Protection during transportation	5	.....	.....
Total score	100	.....	.....

Sanitary conditions are: Excellent.....Good.....Fair.....Poor.....
 Suggestions by inspector

Signed

INSPECTOR.

Sanitary inspection of dairies (reverse side).

Handling the Milk.

Prompt and efficient cooling: If prompt (a), 5; efficient (b), if 50° F. or under, 5; over 50° and not over 55°, 4; over 55° and not over 60°, 3; over 60°, 0; if neither prompt nor efficient, 0..... 10
Storing at low temperature: If 50° F. or under, 5; over 50° and not over 55°, 4; over 55° and not over 60°, 3; over 60°, 0..... 5
Protection during transportation to market: If thoroughly protected (iced), 5; good protection, 4; partly protected, 2; otherwise, 0.... 5

SCORE.

If total score is 90 or above and each division 85 per cent perfect or over, the dairy is Excellent (entitled to registry).

If total score is 80 or above and each division 75 per cent perfect or over, the dairy is Good.

If total score is 70 or above and each division 65 per cent perfect or over, the dairy is Fair.

If total score is below 70 and any division is below 65 per cent perfect, the dairy is Poor.

NOTE. On the reverse side are directions for scoring cows, stables, milk house and milking.

Care of Bottles and Nipples.—Definite and positive directions must be given the mother, and to the nurse, in the mother's presence, as to the care of the bottles and nipples, and a bottle

should be selected which is most easy to clean. The Hygeia nursing bottle has a wide mouth and a large nipple, both of which are very easily cleaned and sterilized. The Arnold Pasteurizing bottle is difficult to clean because of the narrow opening, it being necessary to use a brush in washing. The same objection obtains in the Whitehall-Tatum bottle, which has a wide, flaring base.

New bottles can be annealed by placing them in a vessel of cold water, bringing it to a boil, allowing the bottles to remain in the water till cold. They crack less readily when so treated.

If more milk has been prepared than the baby will take at a nursing, when the child has finished, the bottle should at once be emptied, rinsed with cold water, then with hot, and filled with soda solution, which is allowed to remain in it until the milk is prepared the following day for the next 24 hours. The bottles are then partly filled with soap and water, a tablespoonful of bird gravel is poured in and the bottles each thoroughly shaken, this doing away with the necessity for a brush. They are then rinsed and boiled when they are then ready for use. They should be kept standing bottom up until filled with the modified milk.

Enough nipples should be at hand to use a different one for each feeding. After a feeding they are washed, turned inside out and allowed to remain in a soda or boracic acid solution and boiled with the bottles the following day. Under no circumstances should a long-tube nursing bottle ever be used. It is absolutely impossible to cleanse the tube, and it is a constant source of infection.

The aperture in a nipple should only be large enough to allow milk to escape from it, with the bottle inverted, in drops in quick succession. If it drops very slowly the opening is too small, and should be enlarged very little by the point of a hot needle. If the milk runs in a fine stream the opening is too large and the nipple should be discarded.

The bottle is stood in a cup of hot water until the milk is about 90° F. The temperature of the milk can be ascertained by allowing a few drops to trickle on the back of the hand or

wrist. The practice of some nurses of drawing a few drops from the nipple with the mouth to learn the temperature of the milk cannot be too strongly condemned.

Modified Milk or Percentage System of Feeding.—Because of the marked difference between the amount of proteids of cow’s milk and mother’s milk, cow’s milk must be so altered as to change its fat, sugar and proteid content that it will, as nearly as possible, be adapted to the digestive capacity of the infant and nourish it properly. This may be done in several ways, first by using a definite percentage, centrifugal cream in connection with skim milk and a diluent, and the addition of sugar of milk in order to bring the carbohydrate up to the proper amount. Second, by diluting top milk, which is a specified number of ounces from the top of a quart bottle of milk which has stood four hours in order to allow the cream to rise. Third, by dilution of whole milk.

The ideal method of milk modification is by means of the milk laboratory where a physician’s prescription for a definite amount of the various ingredients of milk can be written upon a blank, and this filled at the laboratory as a prescription for medicine is in a drug store. The best example of this is the Walker-Gordon laboratory, which has established branches in many of the largest cities of the United States. The following is a prescription blank which is used in connection with one of these laboratories:

PER CENT			REMARKS
Fat			Number of feedings
Milk-Sugar			Amount of each feeding
Albuminoids			Alkalinity .....per cent
Mineral Matter			Heat at .....°F.
Total Solids			Infant’s age
Water .....ad	100	00	Infant’s weight
Order			
Date	190		Signature

The following is the latest modified milk prescription card suggested by Dr. Rotch:

NEW PRESCRIPTION CARD SUGGESTED BY DR. ROTCH FOR LABORATORY USE.

EXPLANATORY.		PER CENT.
(a) Gravity cream will be used, instead of centrifugal if ordered.	(a) Fats	
(b) The maximum amount of starch possible in any prescription when used as a nutrient is 1.30 per cent. It requires 0.75 per cent starch to make the precipitated casein finer.	(b) Carbohydrates { Lactose (milk sugar) Maltose (malt sugar) Sucrose (cane sugar) Dextrose (grape sugar) Starch (b)	
(c) One hour completely dextrinizes starch.	(c) Dextrinize	
(d) In case physicians do not wish to subdivide the proteids, the words "Whey" and "Casein" may be erased.	(d) Proteids { Whey Casein	
(e) It requires 0.20 per cent of the milk and cream used to facilitate the digestion of the proteids, i.e., the formation of a soft curd; 0.40 per cent to prevent the action of rennet, i.e., the formation of a tough curd.	(e) Sodium Citrate	
(f) Twenty minutes renders the mixture decidedly bitter.	(f) Peptonize,	

EXPLANATORY.		PER CENT.
(g) It requires 20 per cent of the milk and cream used in modifying to facilitate the digestion of the proteids. 50 per cent of the amount of milk and cream used suspends all action on the proteids in the stomach. 5 per cent of the total mixture gives a mildly alkaline food.	(g) Lime water { Per cent of milk and cream Per cent of total mixture	
(h) It requires 0.68 per cent of the milk and cream used in modifying to facilitate the digestion of the proteids. 1.70 per cent of the amount of milk and cream used suspends all action on the proteids in the stomach. 0.17 per cent of the total mixture gives a mildly alkaline food.	(h) Sodium Bicarb. { Per cent of milk and cream Per cent of total mixture	
(i) Percentage figures represent the per cent of lactic acid attained when the food is removed from the thermostat. When the lactic acid bacillus is used to facilitate the digestion of the proteids, the percentage called for represents the final acidity, as the process is stopped by heat at this point.	(i) Lactic Acid Bacillus { (1) To facilitate digestion of proteids. (2) To inhibit the saprophytes of fermentation.	

EXPLANATORY		PER CENT.
When the lactic acid bacillus is used to inhibit the growth of saprophytes, the acidity may subsequently increase to a variable degree, as the bacilli are left alive. 0.25 per cent lactic acid just curdles milk. 0.50 per cent gives thick curdled milk. 0.75 per cent separates the milk into curds and whey.	When the lactic acid bacillus is not called for in the prescription, heat at....°F. Number of feedings Amount at each feeding .....oz.	

A modifying laboratory has been in operation in connection with the experiment station of the Kentucky Agricultural College of Lexington, Ky., for several years, and the distributing plant of certified milk in Louisville, and the Babies' Milk Fund Association each operate a laboratory.

To obtain a proper conception of milk modification it is positively necessary for one to think of a milk mixture as presenting a given percentage of the principal ingredients of milk, namely, fat, sugar and proteid, and not of how many ounces it takes to make a certain solution or how many times a given quantity of milk is to be diluted. One must think in percentages and not in ounces. He must remember that the basis of all prescription modification is the average analysis of mother's milk and cow's milk.

Dr. T. M. Rotch of Boston first suggested the establishment of milk laboratories, and to him and the Messrs. Walker and Gordon are due the developments along this line.

The home modification may be accomplished in various ways, some more or less complicated, all, however, having the same end in view, that of combining cream, milk sugar and diluent in such proportions that when analyzed it will show a result similar to an analysis of mother's milk.

Before any prescription for modified milk is given, the milk to be used should be examined for the amount of fat content,

the proteid in practically all grades of milk being from 3.2 to 4 per cent.

Estimate of Fat Percentage.—In almost any community can be found a Babcock milk tester, a centrifugal apparatus for the estimation of butter fat in milk. In the graduated bottle of the tester is poured 16.5 cc. of milk, to this is slowly added 17.5 cc. of commercial sulphuric acid (specific gravity of 1.82), the bottle being gently agitated as it is poured in. The milk is curdled, but agitation dissolves the curds. Hot water is then added as far as the beginning of the tube end of the bottle. It is then placed in the machine and revolved, the number of revolutions to be employed per minute being marked on the cover of the tester. More water is added, half way of the tube, and centrifugated again for two minutes. Water is again added to the line indicated on the scale and centrifugated for two minutes. The fat has completely separated now and occupies the top of the column. This is read, the highest and lowest parts of the column of fat marking the limits of the fat percentage.

A very rich milk is not often found in cities. If an analysis is not possible, average milk may be considered to contain from 3.5 to 4 per cent of fat, 4 per cent of sugar and 4 per cent proteid.

Top Milk.—An average milk, if allowed to stand for hours in a quart bottle on ice, will yield in its top 20 ounces 5.8 per cent of fat; the top 16 ounces 7 per cent fat; the top 9 ounces 11.5 per cent fat; the top 6 ounces 16.8 per cent, and the top 5 ounces 19.2 per cent fat, and by diluting these top milks almost any percentage of fat, proteid and sugar can be



Fig 38 —Babcock butter fat test.

obtained. It should be remembered, however, that the proteid in a 16-ounce top milk is the same as in whole milk, viz., 4 per cent. The chief thing to remember, then, is that the top 16 ounces contain 7 per cent fat and 4 per cent proteid, and the top 9 ounces 11.5 to 12 per cent fat and 4 per cent proteid. The proteid content can be increased by adding skim milk

or whey. The carbohydrate content is increased by the addition of sugar of milk. The proteid content of the milk may be modified by the addition of lime water or carbonate of potassium. Those alkaline agents limit the rennet action on the milk and smaller curds are formed.

The whole character of the milk may be changed by peptonizing, which prepares the casein for absorption and neutralizes the acid of the stomach.

If the top-milk method of modification is used the required number of ounces are dipped from a quart bottle by means of the Chapin cream dipper, the milk having previously stood for at least four hours on ice.

By diluting top 10-ounce milk twice, that is 1 part top milk and 1 part diluent, a formula is obtained of fat 3.5 per cent, sugar 2 per cent, proteid 2 per cent. By diluting top 9-ounce milk four times, 3 parts diluent

Fig. 39.—Chapin Cream Dipper.

and 1 part of milk, the result would give a mixture analyzing 3 per cent fat, 1 per cent sugar, 1 per cent proteid.

Thus a number of formulæ can be worked out as follows:

Fat 4 per cent	} Dilute 16 ounces top milk twice.			
Sugar 7 per cent		2) 8% fat,	4% sugar,	4% proteid.
Proteid 2 per cent		4% fat	2% sugar,	2% proteid.

	Ounces
Top 16 ounces from quart	10
Lime water	2
Milk sugar	1½
Water enough to make 20 ounces.	

Fat 3 per cent	} Dilute top 9 ounces milk 4 times.			
Sugar 6 per cent		4) 12% fat,	4% sugar,	4% proteid.
Proteid 1 per cent		3% fat,	1% sugar,	1% proteid.
<div>Ounces</div>				
Top 12 ounces from quart .....				.63
Lime water				2
Milk Sugar				1
Water enough to make 20 ounces.				

Fat 1.50 per cent	} Dilute top 9 ounces milk 8 times.			
Sugar 5 per cent		8) 12% fat,	4% sugar,	4% proteid.
Proteid .50 per cent		1.50% fat,	.50% sugar,	.50% proteid.
				Ounces
Top 12 ounces milk .....				.2½
Lime water				2
Milk sugar				1
Water enough to make 20 ounces.				

Sugar.—By adding 1 ounce of milk sugar, a little less of cane sugar, to 20 ounces of the solution the sugar content is brought to 6 per cent. Three level tablespoonfuls of milk sugar equals 1 ounce in weight, or 2 level tablespoonfuls of cane sugar.

Additional formulæ can be found in the appendix.

Condensed Milk.—This milk is unfit for long-continued feeding because of its large carbohydrate content and small fat content. It is made by evaporating, at a low temperature, a sterilized cow's milk in large vacuum pans to about one-fourth its volume, after which is added about an equal amount of cane sugar which acts as a preservative. The unsweetened condensed milk, termed "evaporated" will quickly spoil if the can is left open. The following is an analysis of condensed milk:

EAGLE BRAND. ¹		<i>Per cent.</i>
Fat		8.8
Sugar		52.2
Total proteid		9.3
Total solids		72.2
Ash		1.9
Water		27.8

¹ Soudern: Kerley, Treatment of Diseases of Children.

The following analyses are given by Chapin, from the United States Department of Agriculture:

COW'S MILK FOR COMPARISON PER CENT.	CONDENSED MILK PER CENT.	WITH 15 PARTS WATER 1 TO 16 PER CENT.	WITH 13 PARTS WATER 1 TO 14 PER CENT.	WITH 11 PARTS WATER 1 TO 12 PER CENT.	WITH 9 PARTS WATER 1 TO 10 PER CENT.	WITH 7 PARTS WATER 1 TO 8 PER CENT.
4.00	Fat 8.44	0.53	0.60	0.70	0.84	1.05
3.50	Proteid 7.23	0.45	0.52	0.60	0.72	0.90
5.00		3.33	3.80	4.43	5.32	6.65
	Sugar { cane, 41.52 } { milk, 11.69 } 53.21					
0.70	Salts 1.80	0.11	0.13	0.15	0.18	0.22
86.80	Water 28.14	95.58	94.95	94.12	92.94	91.18

Owing to the thickness of condensed milk, and the varying sizes of spoons, it is difficult to dilute condensed milk accurately. If a teaspoonful of condensed milk is removed from the can, without allowing it to drip until the spoon is level full, it will contain fully a teaspoonful and a half. Hence, when measuring condensed milk, each spoonful should be allowed to drain until it does not drip, and its bottom scraped off on the can before adding the water. The same spoon should be used to measure the water also.

The reasons for its popularity among the poor is that it is cheap, is easily prepared, and does not spoil as quickly as ordinary milk.

From the analyses given it can readily be seen that the fat percentage in any dilution, even 1 to 8, is much too small, and the mixture in this strength, 1 to 8, is sickening sweet.

As a substitute feeding in difficult feeding cases a weak dilution of condensed milk is of great value, but it does only as a temporary food. If used for some time the fat content can be increased by the addition of a drachm or so of top milk, the gradual resumption of cow's milk being attained in this way.

Kerley has suggested the administration of cod liver oil to augment the fat in condensed milk.

Children fed on condensed milk are usually fat, but flabby, and have little resistance to acute illness.

Peptonized Milk.—In a milk which has been peptonized the proteids have been digested, converted into soluble peptones, and this can be accomplished partially or completely. When completely peptonized the milk has a bitter taste. When milk is used in nutrient enemias it should be completely peptonized, as the bowel in this part is not a digesting organ, but an absorbing one. Peptonizing tubes (Fairchild) contain 5 grains of pancreatine and 15 grains of sodium bicarbonate. The contents of one of these tubes is dissolved in 4 ounces of water and stirred into 1 pint of fresh milk. This is then heated from 105° to 115° F. for 20 minutes. The process of peptonization or digestion can be stopped by placing the vessel on ice or by bringing the milk quickly to a boil. If a child is being fed upon a modified milk and it is necessary to peptonize it, the contents of part of a tube can be added to the bottle before feeding, and the bottle stood in a vessel of water at a temperature of 120° F. and allowed to remain for 20 minutes. It is then cooled to the proper temperature for feeding. Peptonized milk should never be given over a very long period as it relieves the stomach of work which it should be made to do. Completely peptonized milk has a distinctly bitter taste.

Directions for Making Whey.—After removing the cream from a quart bottle of milk, the skimmed milk is heated to a temperature not exceeding 100° F. and removed from the fire. To the heated milk is added two teaspoonfuls of essentia pepsin. (N.F.), or a tablespoonful of liquid rennet or a junket tablet. As soon as a firm curd has formed this is broken up with a fork and strained through a cheese cloth without pressure. It should be cooled and kept on ice until used. If milk or cream is to be added to the whey after breaking up the curd before straining, it should be brought quickly to 150° F., then strained, otherwise the added milk will be curdled by the curdling ferment remaining in the whey.

In certain difficult feeding cases, fat-free whey mixtures can be used to great advantage. Practically all of the casein has been removed, the casein remaining being approximately .35 per cent. The following analyses from Van Slyke show the food value of whey obtained from various grades of milk:

	WHEY. FROM POOR MILK CONTAINING 3 PER CENT FAT	FROM MEDIUM MILK CONTAINING 4 PER CENT FAT	FROM RICH MILK CONTAINING 5 PER CENT FAT
Total solids	6.87	6.96	7.38
Fat	0.28	0.30	0.30
Total proteids	0.69	0.87	1.03
Sugar and ash	5.90	5.79	6.04
Water	93.13	93.04	92.62

When in difficult cases a child has thrived for a time upon whey, an increase both in the fat and proteid content can be had with an addition very gradually of the milk.

Southworth¹ suggests the following method of making whey and of whey feeding:

Method of Making Cream and Whey Mixtures.—Secure a quart bottle of good average milk upon which the cream has risen. Remove with the Chapin dipper the upper 5 ounces of the cream layer, which, when mixed, will contain about 20 per cent of fat, and preserve this for further use. Pour the remainder of the bottle (about 27 ounces) into a double boiler, the lower portion of which contains tepid water, and add 1 tablespoonful Shinn's liquid rennet, or 1 Hansen's junket tablet, or 1 tablespoonful of Wyeth's liquid rennet, or 2 tablespoonfuls of essentia pepsin (N. F.). Mix thoroughly. Place a chemical thermometer in the whey and heat slowly up to 155° (68° C.) to destroy the rennet ferment, which otherwise would clot the casein of the cream or top milk when subsequently added to the whey. Heated beyond 155° F. the albumin, part of the soluble proteids, will be coagulated and the nutritive value of the whey reduced. As soon as a solid curd forms cut this cross-wise into small pieces with a table knife to facilitate the escape of the whey, and while continuing to heat to 155° F. use the flat of the knife blade to assemble and press together the pieces of curd. This increases materially the yield of whey, and the curd finally contracts with heat and manipulation into a rubbery lump the size of the palm of the hand. Straining through a wire strainer now gives 20 ounces or more of moderately opaque yellowish whey, upon which but little fat rises on standing. Adding to 20 ounces of this whey varying amounts of the

¹ Curr: Pediatrics.

top 5 ounces of cream (20 per cent fat), previously removed, will give us a series of formulæ suitable for most purposes where cream and whey mixtures are required. By removing and using the top 6 ounces (17 per cent fat) or top 7 ounces (15 per cent fat), mixtures may be obtained with a lower fat percentage; or by using more of these top milks in the mixture the same amount of fat with a larger proportion of casein in the proteids.

WHEY AND CREAM MIXTURES, MADE FROM 20 PER CENT CREAM (TOP FIVE OUNCES OF ONE QUART BOTTLE) AND TWENTY OUNCES OF WHEY FORM REMAINDER OF BOTTLE.

	FAT PER CENT- AGE.	SUGAR PER CENT- AGE.	PROTEID PER CENT- AGE.
20 oz. whey + 1 oz. cream (20 per cent fat) =	1.00	5.00	0.90
20 oz. whey + 1½ oz. cream (20 per cent fat) =	1.50	5.00	1.00
20 oz. whey + 2 oz. cream (20 per cent fat) =	2.00	5.00	1.10
20 oz. whey + 2½ oz. cream (20 per cent fat) =	2.40	5.00	1.15
20 oz. whey + 3 oz. cream (20 per cent fat) =	2.75	5.00	1.20
20 oz. whey + 3½ oz. cream (20 per cent fat) =	3.15	5.00	1.25
20 oz. whey + 4 oz. cream (20 per cent fat) =	3.50	5.00	1.30

Any case in which mild stimulation is desired an addition of an ounce of sherry wine to a pint of whey is frequently desirable and of benefit.

Ramogen.—Biedert's Cream Mixture, called Ramogen, is a preparation which in certain difficult feeding cases is of some service as a temporary food.

Cow's milk can be added to a Ramogen-water mixture as acute symptoms have subsided. The following analyses have been given in various dilutions:

RAMOGEN.	WATER.	CALORIES IN 100 CC.	PERCENTAGE OF		
			Proteids.	Fat.	Carbohydrates.
1	13	25	0.52	1.23	2.7
1	11 12	26-27	53-.56	1.3-1.36	2.8-3
1	10	30	0.63	1.48	3.1
1	9	33	0.7	1.65	3.46
1	8	35	0.77	1.81	3.8
1	7½	38	0.81	1.93	4.
1	7	41	0.87	2.06	4.3
1	6½	43	0.93	2.19	4.6
1	6	45	0.98	2.31	4.8
1	5½	50	1.07	2.54	5.3
1	5	54	1.15	2.72	5.7

The following analyses is given of Ramogen and whole-milk mixtures:

MIXTURE OF			CALORIES IN 100 CC.	PERCENTAGE OF		
Ramogen.	Water.	Milk.		Proteids.	Fat.	Carbo- hydrates.
1	12½	2	30	0.92	1.39	2.5
1	12	3	33	1.17	1.54	2.8
1	11	3½	35	1.29	1.64	2.88
1	11½	4	37	1.42	1.74	3.0
1	10½	4½	39	1.54	1.83	3.12
1	10	5	41	1.66	1.92	3.24
1	9½	5½	43	1.78	2.01	3.36
1	8	6	45	1.92	2.11	3.5
1	8½	6½	47	2.	2.19	3.6
1	8	7	49	2.18	2.34	3.76
1	7½	7½	51	2.3	2.4	3.9

Calorie.—A calorie is the amount of heat required to raise the temperature of 1 kilogram of water 1° C., which is about equivalent to the amount required to raise a pound of water 4° F., and is used as a unit of measure of food value as expressed in terms of heat production.

Atwater claims that:

One gram of protein furnishes 4 calories; 1 pound furnishes 1920 calories.

One gram of fat furnishes 8.9 calories; 1 pound furnishes 4040 calories.

One gram of carbohydrate furnishes 4 calories; 1 pound furnishes 1820 calories.

It has been suggested by Heubner, Biedert and others that during the first year of life a child should receive about 100 calories per kilo (2½ pounds) of body weight in 24 hours, *i. e.*, for every pound of its weight it should receive sufficient food to provide 45 calories of energy. During the next three months from 40 to 45 calories per pound, decreasing, until at 12 months they consume 32 to 35 calories, daily, per pound of body weight. The following approximate schedule of infant requirement is given by Heubner:

55 calories for the first week.
 107 calories for 2 to 12 weeks.
 91 calories for 13 to 24 weeks.
 83 calories for 25 to 36 weeks.
 69 calories for 37 to 44 weeks.

Pierre Budin¹ states that average composition per liter of human milk is:

35 grams of butter.
 74 - 75 grams of lactose or milk sugar.
 12 - 14 grams of proteids of albuminoids.
 2 grams of mineral salts.
 A total of 175 grams of solids.

He states the most important substance in the maintenance of the body heat is butter, as it is the constituent in milk which contains the greatest number of calories. One gram of butter yields 9.3 calories, and 96 per cent of the butter in milk is utilized by the organism. Of the number of calories representing the average alimentary ration of an infant, that 53 per cent, more than half, come from butter. It is estimated that sugar of milk furnishes 29 per cent, and the albuminoids 18 per cent of the total calories.

It has been shown that the energy equivalent of 1 gram of fat is 9.1 calories; of 1 gram of carbohydrate 4.1 calories, and of 1 gram of proteid 4.1 calories. To calculate the calorimetric requirements, determine from the body weight the number of calories required. A child often requires 45 calories per pound or 450 calories, the first of the equation needed.

An ounce of whole milk contains	21 calories.
An ounce of carbohydrate contains	120 calories.
An ounce of 16 per cent cream contains	54 calories.
One ounce of skim milk contains	10 calories.
One ounce of flour or cereal contains	120 calories.
One ounce of cereal water contains	2 or 3 calories.

The number of calories in the mixture can be obtained from multiplying the number of ounces of the various individual ingredients in the mixture by the above figures and adding the

¹ "The Nursling."

results together to find the energy quotient of the mixture. Divide the total number of calories by the number of pounds and multiply this result by 2.2 to get the number of calories per kilogram.

Diluents in Milk Formulæ.—Because of the fact that the casein of cow's milk coagulates in such large masses in the process of digestion, it has been suggested that the addition of a cereal decoction will enable the stomach juices to coagulate the casein mixture into the smaller flocculi like mother's milk. In order to determine the capacity of an infant to digest starch, Kerley made a large number of stool examinations which showed conclusively that the majority of infants of any age are able to digest starch. He says "that starch foods may be added with benefit to infant-milk foods in a great majority of cases, and that they may be used with benefit as a substitute for these foods in illness is established beyond all question, both experimentally and clinically." The addition of a dextrinizing agent to any of the cereal decoctions is to be recommended, among which may be mentioned plain maltine and cereo, the latter made by the Cereo Company of Tappan, New York. One teaspoonful of cereo to the pint of cereal gruel will completely dextrinize it and render it more easy of digestion and absorption. As to the use of dextrinizing agents, authorities differ, Koplik not advocating their use, except in cases in which it is demonstrated that the infant is not taking care of the plain decoction. In certain marasmic infants in which the percentage method of feeding has failed, Keller's method of dextrinizing gruel may be tried.

Directions for Making Malt Soup.—The following description of a malt soup is given by Keller, as used at the University Children's clinic in Breslau:

Three and a half ounces of malt soup extract are added to 500 cc. of water, or 1 pint, and dissolved. This is solution No. 1. Then suspend 3 ounces (in measure or 2 ounces in weight) of wheat flour in 500 cc., 1 pint of milk, so that the solution is quite uniform. The milk and flour solution is then strained through cheese cloth. The solution of malt extract and that of the milk and flour are mixed together, put into a common

vessel and brought to a boil, being stirred constantly over a slow fire. After about 20 minutes of stirring the whole mixture is brought to a boil to stop all processes of digestion. The mixture is now put up in bottles, each containing about 6 ounces, corked, and kept cool. This mixture contains dextrinized cereal and malt sugar in addition to the proteids of the milk. Loefflund's malt soup extract contains maltose, 57 per cent; dextrine, 12.4 per cent. Wheat contains 66.8 per cent of starch, 7.5 per cent of dextrine, and a small amount of dextrose. By the action of the ferments in the malt extracts—principally diastase—the starches are converted into sugars. By this method a number of easily-assimilable substances are introduced into the economy. The action of these processes on the casein coagulation seems favorable to its assimilation.

This malt soup preparation is recommended in subacute enteric catarrh in which milk in simple dilution is not assimilated. Dr. Keller claims that the acid intoxication which is present in marasmic infants yields to the administration of this malt soup. He found the food of most value in atrophic infants from 6 to 7 pounds in weight, and in infants who after the twelfth month either refuse to take milk food in any form or do not thrive and are stationary in weight. After increasing in weight and taking the foods for two or three months, it is best to take them off the food gradually and accustom them to a modified milk. The chief difficulty in the way of the use of this food is its cost.

Directions for Making Gruels.—Dissolve a tablespoonful of cereal flour in small quantity of water, making a smooth paste, add water to make a quart. Place this in a double boiler, stirring occasionally, allowing it to cook for fifteen or twenty minutes. Only a double boiler should be used as in an open vessel the gruel is easily scorched. If the cereal grains are used, soak two tablespoonfuls in enough water to cover them for ten minutes, pour off this fluid, and add one quart of water, proceeding as if the flour was used. The gruel after being boiled is strained through a coarse meshed cloth, or fine wire strainer, and enough boiled water added to bring the amount to a quart.

To dextrinize the gruel cool it below 140° F., before adding the dextrinizing agent as its diastatic properties are destroyed above that temperature. Cool the gruel and keep on ice until used, making a fresh supply at least every second day.

Ladd¹ has shown that the decoction made by using 2½ ounces of either barley or oat flour to a quart of water, cooking for 30 minutes and adding sufficient water to make 1 quart, yields about 3.50 per cent of starch, and is as thick a solution as can conveniently be strained. This 3.50 per cent decoction has therefore been adopted as the stock solution in the milk laboratories.

On this basis the amount of stock cereal decoction to be added to a mixture of modified milk to obtain any percentage of starch can be calculated by the formula.

By using 3 ounces of the flour to a quart of water, the stock solution of cereal gives 4.5 per cent of starch, and if straining the solution is dispensed with, higher percentages can be given than in the above table, 4.50 being substituted for the denominator, 3.50. An ounce of flour by measure is practically the same as by weight.

Junket.—This is made by coagulating the casein of cow's milk by the addition of Fairchild's essence of pepsin, rennet, junket tablet or essentia pepsin (N. F.). One teaspoonful of pepsin is gently stirred into a pint of fresh, clean cow's milk and the milk brought to a temperature of 115° F. for about 20 minutes. It is then removed from the stove and when a thick curd has formed it is broken up with a fork and can be served with or without sugar. One teaspoonful of sugar can be added.

Protein Milk.—The preparation of *protein milk* might be mentioned to advantage. The buttermilk from which it is made is from a Pasteurized skim milk containing 1.75 per cent of fat. To one quart of this is added one ounce of buttermilk from some reliable dairy. This is allowed to stand for twelve hours at a temperature of 70° to 80° F., is thoroughly beaten at intervals of two to three hours and then placed on ice until used. Each day's buttermilk is made from that of the preceding day, a smaller amount of stock being needed as time goes on. The amount of stock used is determined by the degree of acidity de-

¹ Archives of Pediatrics, April 1908.

sired. The junket is obtained as follows: To two quarts of skim milk, two Hansen junket tablets are added. After standing twenty minutes at 100° F. the precipitated casein is strained through a fine sieve with a potato masher. This process of sieving is facilitated by adding buttermilk to the curd and is continued until the curd is thoroughly broken into fine flakes. One quart of buttermilk, one quart of water, one grain of saccharin to the quart are added to the curd and the whole thoroughly beaten to form a fine suspension. The requisite of the food is the fine flocculent suspension of the curd which depends chiefly on thorough sieving. Boiling the precipitated casein is of no benefit. The composition of this protein milk is fat 0.8 per cent, sugar 2.4 per cent, protein 2.8 per cent, and the caloric value is 8.5 per cent to the ounce. In administering the milk it must not be heated too quickly nor above 90° F., in order to prevent tough masses of casein forming. A large hole in the nipple is necessary and the feeding should be interrupted and the bottle thoroughly shaken every one or two minutes in order to keep the casein from settling to the dependent part of the bottle while the fluid portion alone is being consumed.

Albumin Water.—This is made by adding the white of one egg to a pint of cold water, stirring sufficiently to cause a thorough mixture, but not beating the egg as it is mixed. Owing to the fact that the albumin water is a good culture medium for bacteria, it is not advisable to use this as a substitute feeding in acute dyspeptic or diarrheal diseases in children.

Beef Juice is prepared by first cutting a piece of lean beef into small cubes and while held upon a fork heated through upon a hot plate or pan. The juice is then expressed by means of a meat press or lemon squeezer into a warm vessel. It is possible to obtain from 4 to 5 ounces of beef juice from a pound of steak. Beef juice may be fed plain or in combination with barley water after salting to taste.

Animal Broths.—These may be made from beef, chicken, mutton or veal. A pound of meat cut into small parts is boiled for about two hours in a quart of water, enough water being added from time to time to keep the resultant liquid at about 1 pint. All of the broths should be strained thoroughly through

a fine colander and allowed to cool; the fat which rises to the surface is then carefully removed. As a temporary food they are very good, especially in some of the forms of diarrheal diseases. They contain very little fat, about 1 per cent of proteid and nearly 2 per cent extractives.

Arrowroot Gruel.—This substance has been used as a diluent for milk, as it has the same effect in breaking up the casein as other cereal decoctions. One teaspoonful of Bermuda arrowroot is dissolved in a pint of water, allowing it to cook slowly for 20 minutes, stirring constantly, strained and allowed to cool.

Kumyss is fermented milk, and while sometimes taken by older children it is objected to by a majority. König¹ gives the following analysis of kumyss:

Water	90.44
Alcohol	1.91
Lactic acid.....	0.91
Milk sugar.....	1.77
Proteid	2.44
Fat	1.46
Ash	0.142

Holt recommends the following formula for its home manufacture:

One quart fresh milk, $\frac{1}{2}$ ounce sugar, 2 ounces water and piece of fresh yeast cake $\frac{1}{2}$ inch square, put into wired bottles and kept at a temperature of 60° and 75° F. for a week. The bottles are shaken five or six times a day and then put on ice.

Buttermilk.—Fat-free buttermilk has been used in difficult feeding cases and those convalescent from severe enteric disturbances with great benefit. Because of the great bacterial content of buttermilk from churned milk it has not been considered a safe food, but since the introduction of the pure lactic acid bacteria in tablet form for the artificial manufacture of buttermilk, its use has become more general and the results better.

From a quart bottle of milk the top 12 ounces are removed and 12 ounces of water added in which one lactone tablet has been dissolved. This is shaken and the bottle kept at a tem-

¹ König.

perature of 80 degrees until the milk is curdled, when it is put on ice and the lactic acid fermentation stopped. This is at first given slightly diluted and finally undiluted. Good buttermilk contains from 0.5 to 1½ per cent of fat; 2.5 to 3.5 per cent of sugar, and about 2.5 per cent of proteid. The caloric value of buttermilk averages about 400 calories per liter.

In certain acute intestinal disorders the following method of preparation can be employed: In a quart of buttermilk is dissolved two tablespoonfuls of flour and 3 tablespoonfuls of cane sugar, heat to boiling, stirring constantly, and cooled.

Oatmeal Jelly.—Two tablespoonfuls of oatmeal, rolled oats or Quaker oats, or oat-gruel flour, to 1 pint of water cooked in double boiler three hours, add water to keep the amount at 1 pint. Strain through a colander, allow to cool and keep on ice. One tablespoonful, level, of the flour equals ¼ ounce.

Scraped Beef.—A thick, lean steak is heated through on a hot griddle. With a sharp knife the browned surface is cut off and with a knife held at right angles to the meat, the pulp is scraped away, made into a meat ball, again heated through and fed after salting to taste.

	Barley.		Legume.		Oat.		Wheat.	
	PROTEIDS PER CENT.	CARBOHYDRATES PER CENT.	PROTEIDS PER CENT.	CARBOHYDRATES PER CENT.	PROTEIDS PER CENT.	CARBOHYDRATES PER CENT.	PROTEIDS PER CENT.	CARBOHYDRATES PER CENT.
1 level tbsp. flour to qt. of water	0.12	0.60	0.19	0.53	0.12	0.60	0.10	0.62
2 level tbsp. flour to qt. of water	0.24	1.20	0.39	1.06	0.24	1.20	0.20	1.25
3 level tbsp. flour to qt. of water	0.36	1.80	0.58	1.59	0.36	1.80	0.30	1.88
1 level coverful flour to qt. of water	0.48	2.40	0.78	2.12	0.48	2.40	0.40	2.50
2 level coverfuls flour to qt. of water	0.96	4.80	1.56	4.24	0.96	4.80	0.80	5.00
3 level coverfuls flour to qt. of water	1.44	7.20	2.34	6.36	1.44	7.20	1.20	7.50
4 level coverfuls flour to qt. of water	1.92	9.60	3.12	8.48	1.92	9.60	1.60	10.00

Percentage Cereal Gruels.—The following analysis is given by the Cereo Company of gruels made from their specially-prepared flours. The top of the package has been designed as a measure for the flour. Barley, legume (made from beans), oats and wheat are utilized for preparation of flours. From the foregoing table can be seen the strength of the gruel when larger or smaller quantities of flour are used in the water.

SYMPTOMS OF DISAGREEMENT OF MILK FEEDING.

Insufficient Quantity.—Child will cry immediately the bottle is empty and will suck on its fists.

Too Much Fat.—Vomiting will occur very soon after a feeding; stools more frequent and thin; presence of lumps of a soft material resembling curds.

Too Much Sugar.—Thin, green, sour stools with gas passed with each; an excoriation of buttocks frequent.

Too Much Proteid.—Colic; vomiting; curds in action, frequently in large numbers, either large or small, with much mucus mixed or separate. There may be alternating diarrhea and constipation.

Formula Too Weak.—Stationary weight with constipation.

Talbot¹ has shown “that the curds in infants’ stools are either large curds containing a large per cent of nitrogen and a small per cent of soaps; and small curds containing a low per cent of nitrogen and a large per cent of soaps.” He concludes these curds are composed of some proteid, probably casein or one of its derivatives, which, on coagulating, entangles the milk fat in its meshes. The amount of fat in the curds depends on the amount of fat in the milk, and as the fat increases it replaces the proteid in the curd. The presence of large curds can be interpreted as indicating lack of HCl. “The small curds² are composed mainly of fat, mostly in the form of fatty acids and soaps. There is no evidence that they contain casein-like material, and they have, like the normal stool, a low percentage of nitrogen. They represent the fat in the stool rather than protein.”

¹ Boston Medical and Surgical Journal, January 7, 1909.

² Boston Medical and Surgical Journal, June 11, 1908.

The large casein curds with shiny envelope can be prevented by heating the milk to 170° F. before it is given.

Difficult Feeding Cases.—The above-named symptoms may be present successively as the case progresses and each must be met by appropriate measures. As before stated, one must not attempt to adapt a formula to a certain age. Each child must be a law unto itself. A weak formula in all its ingredients must first be given, even if the digestion has been entirely normal, though it be at the sacrifice of several ounces in the child's weight, rather than upset the child's digestion by a strong mixture, and not be able to get it back on a gaining formula for some time.

The first formula should contain less than 2 per cent of fat and less than 1 per cent of proteid, and this may be increased daily or every other day until the child appears satisfied and evidences a gain in weight. It is the proteid content which will cause the most trouble with the majority of difficult cases, though fat intolerance is frequently seen. I have had under my care one child who, from six months to one year of age, could not be gotten up beyond 3 per cent of fat, the prescription upon which she thrived best being fat, 3 per cent; sugar, 6 per cent; proteids, 2 per cent.

To aid the digestion of the casein, and to assist in its breaking up in small flocculi, several measures have been advocated. Poynton of London suggested the use of citrate of soda in the proportion of 1 grain to the ounce of milk. He claims that sodium paracasein is formed which is absorbed as a fluid. Cotton of Chicago has advocated its use also. The soda is not an alkali but an alkali is needed for the purpose of assisting in breaking up of the curds, and to favor the production of hydrochloric acid, hence the importance of the addition of lime water to the formula. Rotch claims the soda decalcifies the casein, it is then not affected by rennet forming with the acids of the stomach, soft, friable flakes of the buttermilk type.

The following case is an example of this difficult feeding class:

Child born after normal labor of short duration; mother primipara, very nervous temperament, anemic; abundant supply of milk at first but gradual

failure; history in child of slight jaundice; colic, crying all the time; curds and mucus in movements; had been taken off of breast milk and given successively malted milk, barley water and malted milk, barley water and panopepton, albumin water and malted milk, albumin water, Ramogen. Five weeks old when I saw it first; constant crying; tense abdomen; given 2 teaspoonfuls of olive oil and put on a dextrinized gruel and whey, equal parts, 2 ounces every two hours. The first night it slept all night, had two movements, well digested. On third day it was given a mixture of whey, 2 ounces, and barley water, $\frac{1}{2}$ an ounce, and was nursed by the mother twice, with a bottle after each, when about half quantity was taken. On fourth day was put on modified milk fat 1.5 per cent, sugar 6 per cent, proteid .8 per cent. Gained $10\frac{1}{2}$ ounces the first week and in every way seemed normal.

The history of this case is a counterpart of a number that are seen, and unless the child has already developed into an athreptic or marasmic state this plan will usually bring good results.

At the first sign of disagreement discontinue the milk mixture and give one of the cereal decoctions; after a few days try a small amount of whey with the cereal; then add milk gradually. If cow's milk in this form cannot be assimilated, try condensed milk as a temporary food, beginning this with a dilution of at least 1 part to 20 or 24. Top milk may very tentatively be added to the condensed milk and gradually increased, and in this way get on to a gaining formula.

Care of Milk for Journey.—One is frequently asked to suggest a method of preparing milk for a journey. I recently had a box fixed for two children starting for Mexico. A wooden box was built around an ordinary galvanized delivery tray holding 4 quart bottles, a handle and hasp being soldered on. The 4 quart bottles were surrounded with ice and instructions given as to change of ice by car porters en route. Certified milk was sent, and word received from travelers at journey's end reported milk sweet and unchanged. If a modified milk formula had been required for either of these children it could have been prepared and placed in nursing bottles or a quart Mason fruit jar with screw top, and the bottle shaken before each feeding was poured into the nursing bottle.

Diet After the First Year.—Milk should be the basis of a

child's diet for the first 12 months. Weaning (see page 99) should be begun before the twelfth month, and artificial feeding be complete, or nearly so, at that time. At 10 or 11 months of age one feeding a day can be given of strained oatmeal, 2 or 3 tablespoonfuls, over which is poured some of the modified milk. With the advent of the first six or eight teeth, an occasional piece of toast or zwieback can be given the child to chew on.

Only one new article of diet should be given at a time, for if the child takes two new ones and is upset, unless passed undigested, the disturbing cause would not be known.

Regularity of feeding should be positively insisted upon, and the habit of between-meal eating "stopped before it has begun." Nothing but water should be given between meals. The habit of continuing night feedings until the second year should never be allowed.

Too much emphasis cannot be placed on the necessity for thorough and prolonged cooking of cereals for infant feeding, especially oatmeal.

While it is a pleasure but few parents will deny themselves, a young child should not be allowed at the table at the family meal times. The temptation to give the child a taste of this or that is too great to be resisted.

Fruit juices should be given before the end of the first year, orange being usually most enjoyed. It should not be given too close to a milk feeding. After the first year prune juice, if not too sweet, can be given.

The following diet lists are suggested as a guide for feeding after the first year: The first feeding in morning and last feeding at night are usually milk, and the child at this age requires more than can be held in the ordinary bottle, which is made to contain 8 ounces. Whitehall-Tatum Company manufacture a 12-ounce bottle, and at my suggestion the Hygeia Nursing Bottle Company have begun to manufacture a 12-ounce Hygeia bottle, which will be found a great convenience, obviating the necessity of preparing two bottles for each feeding.

From Twelfth to Fifteenth Month.—Five meals a day. The first meal, 6.30 to 7.30 a. m., 8 or 10 ounces of milk; 10 a. m.:

Strained oatmeal jelly, 2 or 3 tablespoonfuls with 4 or more ounces of milk in addition, or soft-boiled egg not oftener than three times a week. Noon: Juice of half an orange. 1 o'clock: Scraped beef and bread crumbs, or rolled zwieback or 4 to 6 ounces of animal broth, with zwieback or Holland rusk. 4 p. m.: Bread and milk. 7 p. m.: bottle of milk.

From Fifteenth to Eighteenth Month.—To the above list may be added the cooked fruits, as prunes, not too sweet; the inside of a baked apple or apple-sauce; thoroughly cooked-rice; boiled or baked potato; junket; finely-minced mutton chop.

From Eighteenth Month to Third Year.—During this period other vegetables may be added gradually, as spinach, asparagus tips, stewed celery, baked potato, peas, beans, fish, thin crisp bacon, minced chicken or turkey, roast beef, cream, crackers, bread and butter.

Sample diet list from sixteenth to eighteenth month:

Breakfast, 7 a. m. Strained oatmeal, 2 or 3 tablespoonfuls, and cream, or barley gruel, and cream with 8 ounces of whole milk.

Second Meal, 10.30 a. m. Milk and stale bread, or cracker, rusk or zwieback.

Third Meal, 1.30 to 2 p. m. Any of the following: Soft-boiled egg (water boiled vigorously, removed from stove, and egg dropped in for two minutes), with broken toast or zwieback; (b) 8 ounces of animal broth (beef, mutton or chicken); (c) a teacupful of junket with milk; (d) thoroughly-cooked rice and milk. Stewed prunes can be given with this meal.

Fourth Meal, 5.30 to 6 p. m. Bread and milk. Fruit juices are given between meals, as suggested in previous lists.

To be Avoided.—Candy should not be given to children under three years of age, and very sparingly after that time. Sweets of all kinds cause a tendency to develop a pharyngeal trouble such as tonsillitis and frequent attacks of "colds" and bronchitis.

Proprietary Foods.—The fact that there are upon the market almost countless numbers of baby foods is evidence enough that none answers the requirements in all cases. These foods may be divided into three classes; first, the so-called milk foods to which water is added, and those foods in the form of powder which

have been suggested as modifiers of milk. The latter are added to milk for their influence upon the casein. Second, the so-called Liebig or malted foods, and third, the farinaceous foods. In the second class the starches are supposed to have been entirely converted into soluble sugars by the diastatic action of the malt. In the third class but a small portion of the starch is converted by the process of cooking.

Among the first class may be mentioned condensed milk and evaporated cream, Prof. Gartner's mother's milk and Ramogen, Mellin's Food and peptogenic milk powder. In the second group, the malted foods, are Nestle's food and malted milk. In the third class a farinaceous or dextrinized food is Imperial Granum, which may be temporarily used alone or in combination with milk.

Mellin's food is used with milk as a modifier, it being claimed that it acts as an attenuant to the curds of cow's milk.

Peptogenic milk powder is used with milk and the mixture submitted to heat. By this process the proteids are converted into absorbable peptones. Nestle's food and malted milk when diluted are deficient in fat and proteid.

Gavage.—This method of feeding is a valuable one in certain classes of cases in which a child will not eat or is too weak to do so, or in which vomiting occurs immediately after food is taken. The same steps are taken as in stomach washing (see page 82). The food mixture is poured into the funnel and when it has been seen to pass the glass tube connecting the catheter with the rubber tube, the catheter is compressed tightly and quickly withdrawn. Gavage may be performed with the patient in a recumbent position or held upright in the nurse's lap, leaning against her shoulder. The writer had the pleasure of observing the cases at the New York Infant Asylum when an interne there, reported by Dr. Kerley in the *Archives of Pediatrics*, February, 1901. It was found in these cases, many of them of persistent vomiting, that water or food introduced into the stomach through the tube was retained when a very much smaller quantity given by the mouth from a spoon or bottle would not be retained. Young children stand the introduction of the tube without discomfort, and gavage can be used

for a very much longer period of time than rectal feeding can possibly be tolerated. A very weak-modified milk, plain or peptonized, cereal decoctions, the concentrated foods, as panopepton and stimulants, may be given in this way. In cases of diphtheria or those wearing an intubation tube, the stomach tube is best introduced through the nares.

Rectal Feeding.—This method of nourishment is a valuable one when all others have failed, and may be the means of tiding over a desperate case until nourishment can be given in other ways. The food for administration in this way should be as near as possible free from fat and completely peptonized. Completely peptonized or pancreatized skimmed milk, mixed with albumin water of double strength, namely, the whites of two eggs and a pint of water, can be used to advantage. This should be heated to about 100° F. as it loses several degrees of heat in its passage through the tube of the fountain syringe, if this syringe is used to insert it. The food is best inserted through a small-size short rectal tube (No. 14A) which can be attached to a small rubber tube of the fountain syringe, or the fluid can be injected with a hard rubber or glass piston syringe; care must be taken to invert the syringe to be sure that all of the air is first expelled. The child is placed upon its left side, hips elevated by raising upon a rubber-covered pillow, its thighs flexed upon its abdomen much as in the Sim's position; the tube is anointed well with vaseline from a tube, and the external sphincter also greased. The tube is then inserted slowly to the distance of 9 or 10 inches and the nutrient enema slowly injected. Not more than 3 ounces should be injected in a child of six months of age, nor more than 6 ounces in a child of three years of age. After the injection the tube is compressed and quickly withdrawn, and the child's buttocks compressed firmly and the child held in the original position, if possible; if not, it is allowed to lie upon its back with legs and thighs flexed. These enemas can be given as often as three or four times in 24 hours, but if given much oftener than this the bowel soon becomes intolerant and they are expelled as soon as introduced.

In this connection might be mentioned the great benefit obtained from the high colon injection of water in cases of

deficient kidney excretion, as the absorption from the colon is both rapid and prompt. The method of Murphy suggested originally for use in septic peritonitis in both adults and children, viz., the continuous rectal injection may also be employed to advantage. It might be well before the injection of the nutrient enema to give a preliminary colon irrigation to thoroughly cleanse the lower bowel and render it more absorbent.

CHAPTER VIII.

DISEASES OF THE NOSE, THROAT AND LARYNX.

ACUTE RHINITIS.

Synonyms.—*Coryza, acute nasal catarrh, snuffles.*

Etiology.—The most frequent cause of this condition is a growth of adenoid tissue in the nasopharynx. Its occurrence in infants is comparatively frequent, and in the presence of acute symptoms in the nose the nasopharynx should be investigated. Congenital deformity of the nose, or deformity resulting from an injury may mechanically act as a predisposing cause.

Exposure of the child, being uncovered at night, with a wet napkin, may cause trouble because of the extra work thrown upon the air passages from interference with the skin by chilling.

Pathogenic organisms are a potent factor, as a dust-laden air. A child should never be kept in a room which is being swept.

Pathology.—The entire mucous lining of the nose is much congested and swollen, due to an increase in the size of the blood vessels and infiltration of lymphocytes in surrounding tissues. A watery secretion is at first thrown off, followed by a mucopurulent one.

Symptoms.—There is at first sneezing and rubbing of the nose; restlessness and difficulty in breathing through the nose. This is specially true in infants when nursing, breathing being much interfered with because of the swelling of the nasal mucous membrane. Occasionally there is a slight rise of temperature, rarely more than 2° F. There may be a swelling of the submaxillary glands. If the discharge is profuse there may be an excoriation of the skin of the upper lip with a formation of crusts or scabs at the nares.

Diagnosis.—The possibility of a nasal diphtheria developing primarily should be borne in mind, and a careful inspection

of the nasal mucous membrane made for the presence of a pseudomembrane. The nose on examination will be found occluded, the red and swollen turbinal tissues touching the floor and septum.

If the condition does not respond to treatment and becomes chronic, the possibility of its being a manifestation of congenital syphilis must be borne in mind.

Treatment.—Calomel, gr. i to a nursling in one dose, or in repeated small doses, or a castor oil purge, will prove beneficial. There is no contraindication to air, but there should be no draughts. Unless it be very cold, the child does much better if out of doors in a protected perambulator.

A 50 per cent boracic acid solution, as an irrigation, is of benefit. This should be followed by a weak boracic acid and vaseline ointment, gr. i to $\frac{3}{4}$ i, applied to the nasal mucous membrane on a cotton swab. In older children an oily spray of benzoinated albolene is of benefit. Adrenalin solution, 1-5,000 applied to the mucous membrane by a cotton swab is beneficial. A few drops of a 2 to 4 per cent argyrol solution is helpful also.

The use of cold spinal douches is of great benefit in preventing attacks in children predisposed to them. An effectual method of applying cold to the chest and back is by wringing a sponge or coarse washcloth out of cold water and rubbing the skin back and front as far as the waist each morning, followed by a brisk rub.

CHRONIC RHINITIS.

This form is rare in children and follows the acute frequently or may appear as a manifestation of rachitis, adenoids, nasal polypi, which are very rare in children, or any general condition of impaired nutrition. A nasal discharge from one nostril should always make one suspicious of a foreign body in the nose.

The removal of the cause of the chronic form is usually followed by relief unless there is a hypertrophy of the turbinate bones. The treatment is essentially that of the acute variety; antiseptic sprays and douches, Seiler's and Dobell's solutions are of great benefit.

ATROPHIC RHINITIS.

Atrophic rhinitis is found in children with comparative frequency, oftener in females than males, and begins more frequently at about the age of 12, though it may begin earlier. It rarely begins after adult life is reached.

There is a chronic nasal catarrh, often involving the pharynx and larynx.

Etiology.—The exact cause is not known. Anemia, unhygienic surroundings are causes. One of the latest theories is that it follows accessory sinus disease, as it is frequently associated with sinus disease.

Symptoms.—There is a thick yellowish discharge, which dries quickly, forming thick crusts. These and the discharge beneath have a very disagreeable odor, this being known, as in adults, as *ozena*. This odor is characteristic and peculiar to this condition, the patient not being, as a rule, cognizant of it at all. The child does not breathe readily through the nose because of the crusts. *Epistaxis* is common from dislodgement of the crusts following picking of the nose. The facies is much the same as found in uncomplicated adenoids, *aprosexia*, and they frequently complicate this form of catarrh, in about 5 per cent of cases. Hypertrophy of the turbinates is also present in about the same percentage of cases. Otitis media is a complication met in about 10 per cent of cases.

Prognosis.—This is bad, as far as a cure is concerned. Some cases recover spontaneously.

Treatment.—Attention to all abnormal conditions of the nasal mucous membrane as soon as diagnosed is most important as a prophylactic. Active treatment in the form of cleansing sprays may be ineffectual because of the tenacity of the crusts. Dobell's and Seiler's solutions or the following:

Sodii bicarb.

Borax.

Table salt.

Equal parts.

S.: One teaspoon to a tablespoonful in a quart of boiled water, one-half to be used in each nostril.

These solutions are best used in a fountain syringe.

If the odor is bad permanganate of potash, 2 grains to the pint of water, can be used in the same way.

If the patient is old enough, and is tractable, office treatment is efficient. Applications can be made, consisting of iodine, 2 per cent in glycerine, or ichthyol or nitrate of silver solution, 2. per cent, with massage of turbinates. Plenty of fresh air, tonics, iodide of iron, etc., are specially indicated.

EPISTAXIS.

A hemorrhage from the nose.

Etiology.—Trauma is the most frequent cause, though it may be a manifestation of a general condition, as in typhoid fever, scorbutus, hemophilia. Nosebleed may be the first symptom of adenoids, being due to the intense congestion of the turbinals, which is secondary to the adenoid growth.

Older children who have suffered from a rhinitis pick the nose to remove encrustations, and abrasion of the mucous membrane frequently results, causing more or less bleeding. Young girls who have a very heavy suit of hair are prone to have frequent hemorrhages from the nose.

Rarely it may be a manifestation of puberty as a vicarious menstruation.

Symptoms.—Hemorrhage from one or both alæ is the principal symptom, or if it is at all severe the symptoms of acute anemia will result. If the bleeding is from the posterior nares but little blood will escape from the anterior nares, but will be spit up or swallowed. Vomiting always follows this.

Treatment.—The nares should be cleansed and with good illumination they should be closely examined for bleeding areas, which can frequently be found upon the septum. An application of chromic or trichloroacetic acid or 20 per cent solution of nitrate of silver upon a cotton-tipped applicator to the bleeding point will usually suffice to arrest it. In the milder forms tannic acid, and often adrenalin will suffice. The galvanic cautery is most satisfactory if patient can be controlled. It may very rarely be necessary to pack the nares with a cotton pledget.

Lemon juice applied to the mucous membrane is an efficient styptic agent.

NASAL POLYPI.

These growths, which usually arise from the middle turbinate bones, are infrequent in infants, but sometimes found in older children. They usually have a pedicle much smaller than the body of the polyp.

Not infrequently the mucous membrane covering the lower and anterior border of the septum is hypertrophied and causes



Fig 40.—A. Crypts, very irregular and uneven. Cross section of human tonsil, age 11 years, dissected out in capsule. X10. Moderately hypertrophied with greatly dilated crypts filled with detritus. (Courtesy Dr. Harry A. Barnes.)

an obstruction to the nares much like that from a polyp. These polypi may be papillomatous in character, cystic or fibrous.

Symptoms.—No symptoms are usually present until the polyp is of such size as to mechanically interfere with the breathing when they are those of a rhinitis. There is a discharge from the nose and inability to breathe with freedom through the affected side, headache and restlessness at night.

Treatment.—The polyp should be removed early. It may be accomplished by means of the snare, forceps or excision, the snare being preferred.

DISEASES OF THE TONSILS.

Too much emphasis cannot be placed on the importance of a consideration of the tonsils in childhood. They bear an important relationship to many of the severe illnesses of that age,

as they are the port of entry of many specific organisms to the lymphatic and general circulation.

The tonsils are situated between the pillars of the fauces, and are a collection or masses of lymphoid tissue, which have within them a number of crypts. These crypts are lined with squamous epithelium.

The tonsillar membrane is easily infected and the subsequent inflammation results in great swelling of the tonsils, and in many cases a rapid exfoliation of the epithelia in the crypts, which with the fibrin and serum rapidly fill up the crypts, the swollen tonsil being dotted with yellowish-white spots. In the catarrhal variety of tonsillitis the crypts are empty, the exfoliated epithelia being thrown off. Occasionally the crypts contain a small concretion of broken-down cells and serum in a hardened mass, which decomposes, giving to the breath a most disagreeable odor.

The relationship between tonsillitis and rheumatism has been referred to elsewhere. The local manifestation of this general condition should always be borne in mind.

TONSILLITIS.

Two forms of tonsillitis can be considered, the *acute catarrhal* and *follicular*.

Acute Catarrhal Tonsillitis.

Etiology.—This variety is more often seen as a manifestation of rheumatism. Exposure to cold, wet feet, and indiscretions in diet are the most frequent causes. Children who are fed sweets indiscriminately are especially prone to develop tonsillitis. Crowded school and sleeping rooms with improper ventilation is frequently a contributing cause to this condition.

Symptoms.—The first symptom may be a chill or perhaps an elevation of temperature. The child will, more than likely, not complain of its throat at all, or perhaps only when it swallows. It may have pain or discomfort in its joints, manifested only by crying when moved or handled.

Food is frequently refused, due chiefly perhaps to the pain in the throat, which is not otherwise complained of.

The temperature is always elevated, it may be to 103° F., which lasts for two or three days, gradually subsiding. There are remissions but it does not reach normal. Because of the infrequency of complaint in regard to the throat from both infants and children no examination should be considered complete without a thorough inspection of the throat by either a good direct light or a reflected light from a head mirror.

The inflammatory process is rarely limited to the tonsils, as there is a more or less extensive involvement of the pharyngeal mucous membrane.

The tonsils will be found enlarged, very red and granular in appearance, and if the child gags when the tongue is depressed the tonsils may approximate in the center.

The bowels are usually constipated and it is not unusual for vomiting to occur at the onset.

Prognosis.—This is good in an uncomplicated catarrhal tonsillitis, but the danger is always great of an infection occurring of the tissue behind the tonsil, and the formation of a localized abscess. The occurrence of frequent attacks of catarrhal tonsillitis is suggestive of a rheumatic diathesis.

Treatment.—An initial dose of calomel in all tonsillar and pharyngeal inflammations is a positive indication. The dose should be larger than is ordinarily given children, at least 2 grains for a child two years old. This should be followed by a dose of aromatic cascara, milk of magnesia or other palatable laxative.

One of the salicylates should be given, preferably aspirin, in dose of 3 grains at three- or four-hour intervals to child of three years.

Locally an astringent application should be made to the tonsils, as Loeffler's solution or tannic acid:

LOEFFLER'S SOLUTION.

R	Mentholi	10 gm.
	Toluene	q. s. ad 36 cc.
Add.		
	Creolin	2 cc.
	Liq. ferri chloridi	4 cc.
	Alcoholis	q. s. ad 100 cc.—M

A cold, wet compress applied to the throat is of great benefit. In very acute inflammations with high fever these may be renewed every hour.

The control of the diet is most important and sweets should be eliminated entirely from the bill of fare.

Follicular Tonsillitis.

Synonym.—Acute lacunar amygdalitis.

Etiology.—The streptococcus, staphylococcus and pneumococcus are probably the most frequent offenders. They gain entrance to the tonsillar crypts and there set up a severe inflammation.

Exposure to cold or wet, and the rheumatic diathesis are predisposing causes.

Age is a factor. It is decidedly more frequent under the age of 15 than over that age. Infants under six months of age are infrequently affected. Previous attacks act as a predisposing factor.

Symptoms.—The onset is sudden. While a distinct chill is difficult to determine in a child it may evidence itself by cold and blue extremities, pallor of the face and blanched lips.

In older children the aching of the joints, back and legs is quite severe, but the only manifestation of this symptom in an infant may be, as in the catarrhal variety, crying when it is picked up.

The temperature is elevated to 103° F. or 105° F., with remissions of 1° or so, and lasts from three to four days. The pulse is correspondingly rapid. In some the respirations may be faster as a result of the temperature and toxemia.

There is anorexia, often vomiting and the bowels irregular. During the latter stage there may be thin and green stools from the infection following swallowing the mucus from the throat. Inspection of the throat shows enlarged tonsils, very red, and studded with white spots. These spots are the ends of accumulations of broken-down epithelium, serum and fibrin in the crypts, and as they are squeezed out of the tonsils may coalesce on the surface of the tonsil and form a pseudomembrane.

The pharynx is deeply congested and swollen, and the uvula

edematous and red also. This condition may be present and no complaint of the throat be made, which emphasizes the importance of a careful examination of the throat in every case of illness in a child. Sometimes it is quite painful to swallow.

The lymph nodes at the angle of the jaw and under the ramus may be enlarged. The tonsils can be easily palpated externally.



Fig. 41.—Osteomyelitis following streptococcal infection from tonsillitis. (Courtesy Dr. C. B. Spalding.)

The *duration* of an attack is usually four or five days, the temperature falls by lysis, the tonsils are clean and gradually reduced in size, and the aching is entirely relieved.

Complications.—Infection of the middle ear, retropharyngeal and retrotonsillar abscess, osteomyelitis endocarditis may complicate the convalescence.

Prognosis.—In uncomplicated cases this is good.

Diagnosis is chiefly to be made from *diphtheria*. This frequently cannot be made without a careful bacteriologic examination. In suspicious cases a culture should always be made. Again a case may begin as an uncomplicated follicular tonsillitis and develop into diphtheria. The pseudomembrane in follicular tonsillitis can be removed without leaving a bleeding surface below as occurs in diphtheria.

Treatment.—Calomel should be given as soon as the diagnosis is made, followed by a saline if possible. A portion of a bottle

of citrate of magnesia can be given usually. Castor oil is also of benefit.

If the child is old enough to gargle a 50 per cent solution of peroxide of hydrogen is of great service in softening and removing the exudate. Any mild antiseptic solution can be used as a gargle, Dobell's and Seiler's solutions are efficient.

Locally the tonsils should be touched with a mop saturated with an astringent solution, as tannic acid or Loeffler's solution.

The application of powdered aspirin directly to the tonsil has been suggested as an excellent remedy.

Internally aspirin should be given, as in catarrhal tonsillitis, followed during convalescence by the tincture of the chloride of iron.

R Tinct. ferri chloridi ʒi
Glycerine ʒiii
Aquæ destillat. q. s. ad ʒii.—M.

Sig. One teaspoonful every three hours, diluted.

Rest in bed and isolation are positive indications and should be insisted upon.

Cold compresses, or the opposite, hot applications may give great relief.

Chronically Enlarged Tonsils require surgical intervention. Whenever several distinct attacks of tonsillitis have occurred in a child, leaving in the interim much enlarged tonsils, or when associated with aural complications as progressive deafness, catarrhal and suppurative otitis media, or persistent enlargement of the glands of the neck, they should be removed, as they are a constant menace to the child from infections of many kinds.

Symptoms.—Adenoids are usually associated with chronic-tonsillar hypertrophy and the symptoms are more or less the same. There is a facial expression peculiar to this condition; disturbance of the speaking voice; mouth breathing; disturbed sleep; snoring; and frequent attacks of acute tonsillitis.

In a young child, the tonsils should be removed under a general anesthetic, gas, ether or chloroform. The operation is not as easily done under a general anesthetic as without, but the inconvenience to the operator is more than counterbalanced by the comfort of the patient. It is brutal to forcibly hold a child

and remove first one tonsil and then the other, and the shock to the nervous system is one which is recovered from only after a great while. I appreciate that this opinion is at variance with the ideas of many specialists, yet I am convinced this is correct. The tonsils should not be removed too soon after an acute attack of tonsillitis, as the danger of postoperative hemorrhage is too great. There have been a number of deaths from hemorrhage after tonsillotomy, and this danger should always be borne in mind.

Tonsillotomy.—The instrument is chosen with the aperture of the proper size to allow the tonsil to easily slip through, slight pressure is made externally and being assured nothing but the tonsil is embraced in the instrument, pressure and traction are made by the thumb and fingers and the instrument with tonsil

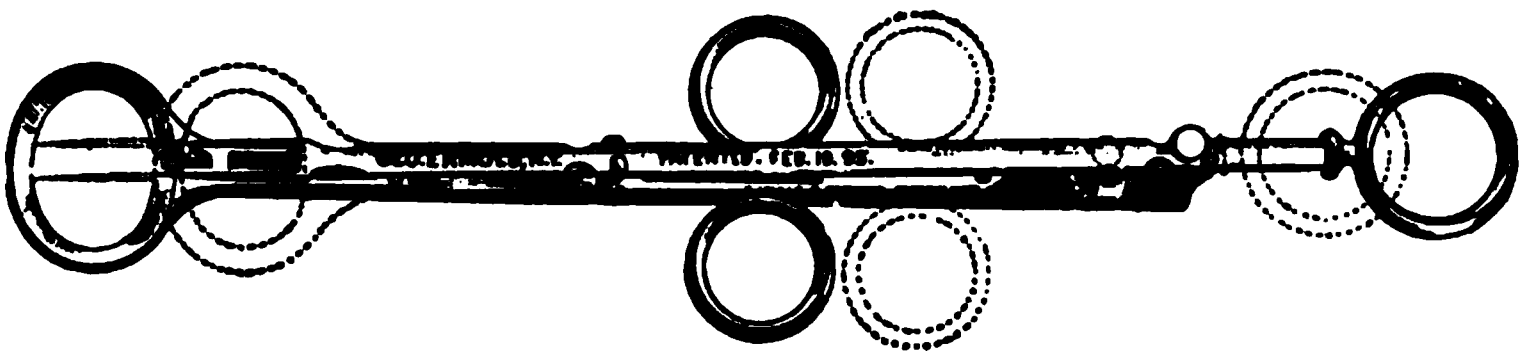


Fig. 42.—Tonsillotome.

impaled upon the prongs, is removed. The same or a fresh instrument may be used for the opposite tonsil, but the second should not be removed until the bleeding has been stopped by pressure with a hemostat holding a small gauze sponge.

Tonsillectomy.—Complete enucleation of the tonsil, has, in the hands of most operators completely supplanted the old method of tonsillotomy. The instruments needed are a tongue depressor, or a needle threaded with silk fifteen inches in length which is put through the end of the tongue at the frenum for the purpose of making traction and doing away with need for a tongue depressor; a tonsil knife for freeing tonsil from faucial pillars; volsellum forceps, and two snares, armed with silver wire. The patient, under a general anesthetic, lies upon its back, with right shoulder elevated by sand bag and head turned to operator sitting on its left side. The tonsil is grasped by the volsellum, the mucous membrane incised, and the tonsil freed of its lateral at-

tachments. The snare is then slipped over it and the entire tonsil enucleated with its capsule. While pressure is being used with forceps and sponge to allay hemorrhage more anesthetic is administered for the removal of the second tonsil. The second or upper tonsil is treated in the same manner, hemorrhage stopped, and the adenoid then removed. The patient is then turned over, head well over the edge of the table, and cold cloths applied to throat and forehead. A whitish deposit forms over the base of the tonsil which greatly resembles a pseudo-membrane, and without knowing what had been done, one might easily be led into a mistaken diagnosis of diphtheria. This disappears in four or five days.

UVULITIS.

An elongated uvula is sometimes seen in older children, rarely in infants.

Symptoms.—There is an irritation in the throat, a hacking cough, especially when the patient is recumbent, and a constant desire to swallow. There may be pain on swallowing. The cough may be suggestive of bronchitis, but no signs are found in the chest, unless there is an associated bronchitis.

Treatment.—The application once or twice daily of an astringent solution will usually suffice. The following is recommended:

R	Acidi tannici	3ss
	Glycerini	3ii
	Listerine	3ii
	Aquæ dest.	q. s. ad. 3iii
	M. et ft. sol.	
	Sig. Apply on cotton swab to uvula.	

In older children a gargle of Dobell's solution is beneficial. If the condition is chronic and does not respond to local applications, an excision of the tip of the uvula may be necessary. Care should be taken to limit the excised portion to the tip of the mucous membrane, not cutting the muscle, in which event the pain following is very severe.

Cold applied by eating ice, and cold cloths externally is of great benefit in relieving the pain following the operation.

PERITONSILLAR ABSCESS.

Synonym.—*Quinsy*.

Etiology.—An infection from a tonsillitis or diphtheria is usually the cause. This affection is very rare at the extremes of life.

Symptoms.—Pain in the throat, inability to swallow without its being greatly exaggerated and a peculiar voice, as if it were full of hot mush, are the principal symptoms. Stiffness of the neck, pain on opening the mouth, and pain referred to the ear. There is also an increased flow of saliva, which is swallowed with difficulty. An examination shows a very edematous area near the tonsil, which usually is very glassy in appearance. The uvula is pushed to one side by the accumulations of pus from behind.

Prognosis.—A few cases have been known to rupture during sleep, pus entering the larynx, producing death by strangulation. Edema of the larynx may follow also.

Treatment.—The accumulation may be quite tense and require but a very superficial incision to evacuate the pus. The position of the ascending pharyngeal artery must be remembered in making the incision. In others the pus is difficult to locate as it constantly burrows behind the fascia but finally toward the surface and may rupture spontaneously. Relief is almost immediate as soon as the abscess is drained.

Hot applications and hot gargles assist materially in reducing pain and hastening rupture.

RETROPHARYNGEAL ABSCESS.

The retropharyngeal nodes become infected by bacteria through the medium of the lymphatics, in tonsillitis, measles and other septic conditions. It may be due to vertebral caries, and as a complication of tuberculosis, rickets and syphilis.

It occurs comparatively frequently in infancy and childhood, especially during the first year.

Symptoms.—The acute symptoms, pain and obstruction to swallowing, may begin abruptly. The glands at the angle of the jaw are swollen and tender. The usual examination of the

throat may reveal the cause of the trouble at first glance, and the finger introduced in the mouth will feel the doughy tumor extending beyond the reach of the finger. Hoarseness is present if the abscess presses down upon the larynx.

Treatment.—The positive indication is to open the abscess and evacuate the pus through an opening as large as possible.

I have seen one infant of four months in which the first examination by the finger caused dyspnea, necessitating intubation.

ADENOIDS.

Pathology.—An hypertrophy of the lymphoid tissue or the mucous glandular tissue in the nasopharynx or vault of the pharynx is designated as an *adenoid* growth. The growth may be lobulated and attached by one base, or there may be more than one of these masses. The mass when removed may resemble a bunch of grapes in its conformation.

Owing to the passive congestion of the nasopharyngeal mucous membrane from pressure and mechanical irritation of the growth there is a constant secretion of mucus, escaping through the nares and into the throat.

Bacterial growth in the nasopharynx in which there are adenoids is very active, the pneumococci, streptococci and staphylococci being most often found.

The mucous membrane around the opening into the Eustachian tube, and extending up the tube, is congested and swollen, and bacteria are present.

The frequency of adenoids has been given as from 15 to 50 per cent of all children.

Etiology.—It is often a family characteristic. Rachitis, bad hygienic surroundings, chronically enlarged faucial tonsils, thumb sucking, indiscretions of diet, especially liberal eating of sweets, are among the causes of this condition.

Symptoms.—A child with adenoids usually presents a train of symptoms which are fairly characteristic. It is more than usually susceptible to "colds," having the snuffles and a constant nasal discharge; breathes through the mouth, both asleep and awake, but especially when asleep and lying upon its back; it is inattentive from deafness, and apathetic, due to impoverished

blood from respiratory obstruction; complains frequently of ear-ache.

After adenoids have existed some time the change which takes place in the conformation of the face is fairly characteristic. Guye has designated this facies as *aprosexia*. There is a peculiar prominence of the nasal bones, giving a tendency to an appearance called hatchet face, the lips are partially open to permit of mouth-breathing, as it is impossible for a free exchange of air to take place through the nose.

It has been generally believed that adenoids were peculiar to children beyond the age of two years, but it has been found by a number of observers that they occur in early infancy, the earlier they occur the more serious the after-effects, unless early remedied. There is a greater tendency to recurrence of the growth after removal in the very young.

Owing to the low position of the nasopharynx in infancy and its relatively greater length from before backward, and the smallness of the nose and its cavities, a very small growth causes greater obstruction. The presence of adenoids in an infant interferes with its nasal respiration to such an extent that sucking and swallowing are much interfered with, and these interferences with nutrition, and insufficient oxygen, cause a condition of malnutrition which is oftentimes very serious. All of the diseases of malnutrition, especially rickets, are apt to follow, deformities of the chest, the so-called pigeon breast, is frequently seen. It is often necessary to differentiate adenoids in which there is a constant "snuffles" from congenital syphilis. Infants so affected are restless at night, waking frequently, and this interference with proper rest adds greatly to the state of malnutrition. The following application may be made to the adenoid-bearing area, but without much hope of causing absorption.

R Tinct. iodini	3ss
Menthol	gr. ss
Benzoinated albolene	ʒi.

M. Sig. Five drops in anterior nares with child lying on back.

In later childhood it is rare to find a case presenting adenoids that does not also show considerable enlargement of the faucial

tonsils, and it is a fact frequently recognized that if the adenoids are removed and the faucial tonsils left the tendency to the recurrence of adenoids is very great.

Owing to the tendency to rapid propagation of pathogenic bacteria in the nasopharynx in which there are adenoids the complication of infection of the middle ear is very frequently observed. The nasopharynx is filled by the growth which presses on the opening of the Eustachian tube; this interferes with the air in the middle ear and deafness, which is a prominent feature of these cases, is caused.

Treatment.—There is but one treatment for adenoid growth and that is surgical. A number of observers have tried the effect of local application of absorbofacients and internal administration of the iodides with no effect whatever. There is perhaps no operation that in itself is so simple, which gives rise to such excellent and prompt results, as the cleaning out of the nasopharynx of an adenoid growth sufficient in size to give symptoms.

In infants the removal can frequently be accomplished without the use of instruments, as the mass of tissue is so soft as to make it possible to crush it and remove it by the finger.

In older children it is my opinion that the operation should never be done without a general anesthetic. The dangers of the anesthetic are greatly outweighed by the shock to the nervous system, from forcibly holding the patient and brutally scraping out this growth. Cases in which this operation is done without an anesthetic are much more apt to have the growth recur from the incompleteness of the operation. In competent hands the best anesthetic is chloroform. I make this statement in spite of the statistics showing the comparative greater safety of ether over chloroform. I have given chloroform for this operation a great number of times without ever seeing a dangerous symptom. The patient should be recumbent upon the table upon which the operation is to be done, and the anesthesia produced should be only to the primary degree. The mouth gag of the O'Dwyer intubation set is then introduced, the head brought well to the edge of the table and below the level of the body, the face turned to one side. The hair is pro-

tected from soiling with the blood by a rubber bath cap which fits snugly over the forehead and under the occiput. With the patient anesthetized only to the primary stage there are still some reflexes present, and the tendency to swallow blood is much less than if they are completely under the anesthetic. There are few operations in which the loss of blood is as great for the amount of work done; and for this reason it is always well for members of the family not to be present during the operation.

The child lying upon its back, the shoulders are pulled to the edge of the table, the head lowered, with the face turned to the side, the mouth held open with the gag and the finger as a guide, the growth is removed by means of the curette, which ordinarily will remove the entire mass in one or two scrapings. The roof of the pharynx must be carefully investigated with the finger to ascertain if entirely clean. The danger of secondary hemorrhage is very slight, although a few cases have been recorded of this nature. After cleansing the face the child is put to bed with head flat, and the family warned of the possibility of its vomiting blood which may have been swallowed during the operation. If there is no nausea following, in the course of an hour or so, crushed ice may be given the patient if it craves water, and later ice cream or cold milk when nourishment is necessary.

As a rule no after treatment is needed, and the beneficial effects of the operation while generally not immediate are very soon noticed in the relief of all previous disagreeable symptoms, the first usually to disappear is the snuffles or symptoms of cold in the head. There is a change in the voice and the child is less restless at night, and the mouth-breathing soon disappears. In those who have been in the habit of breathing through the mouth for some time it may be necessary to frequently remind them of the necessity of keeping the mouth closed.

DISEASES OF THE LARYNX.

Acute Catarrhal Laryngitis.

Synonyms.—*Croup. Spasmodic croup. Catarrhal croup.*

Etiology.—Exposure to cold is the most frequent predisposing cause. Any of the bacteria found in the throat in tonsillitis

may be the active cause of the inflammation. The bacillus of diphtheria is not present, as a membrane would be the result of such invasion and a true croup caused.

Symptoms.—The child is usually put to bed in apparently a normal condition. It may perhaps have had a slight hoarseness or a hacking cough during the day or several days previously, or a slight coryza without the cough. After having been asleep for some time it will cough, the sound produced being harsh and brassy which is the characteristic croupy cough, and which strikes terror to every mother's heart. This cough may awaken the child, and there is a rasping character to the inspiration and the cry, which may be heard and recognized some distance away. If very severe the child may show considerable pallor and exhibit other symptoms of dyspnea, clutching at the throat with a recession of the supraclavicular and infraclavicular spaces with each inspiration. The skin is clammy as a rule, though there may be a dusky flush to the cheeks if there is any fever, which is usually below 103° F.

The spasmodic stage may last some hours, but it is usually shorter in duration, and by morning the child is asleep and breathing quietly. During the day it will play around without, as a rule, much hoarseness evidencing itself. The croupy cough, however, usually recurs the following night or for several nights, however, less severe as a rule.

Diagnosis.—This must be made from *laryngeal diphtheria*. In this the symptoms grow gradually worse, instead of disappearing during the day, to recur at night, as in catarrhal laryngitis. Some membrane is usually present in other parts of the throat, in diphtheria.

In *laryngismus stridulus*, the pronounced croupy cough is not so prominent, the dyspnea and stridor being most marked. There is no fever in laryngismus and the duration is shorter. Laryngismus is a prominent symptom of rickets, and does not occur in other conditions.

Prognosis.—This is good when uncomplicated.

Treatment.—If the stridor is great, the best results can be had by giving a preliminary dose of syrup of ipecac of 20 to 60 drops, for its full effect upon the stomach. After vomit-

ing, the whole aspect of the case is usually changed, as by doing so the mucus in the trachea and larynx is dislodged and this mechanical obstruction removed. This dose can be repeated at half hour or hourly intervals as needed to produce emesis. Con-

tinuing the effect of relaxation, good results are had from antimony and ipecac, 1/100 grain each, every hour.

Excellent results are had from allowing the child to breathe steam, and the "croup kettle" which generates steam by the bedside, should be used. One tea-spoonful of the tincture of benzoin to a pint of water vaporized is of great service. When the child is asleep a sheet tent should be erected over the crib so as to confine the steam. The kettle, as long



Fig. 43.—Croup Kettle.

as the lamp is lighted, should be closely watched and not left unattended at all.

For severe cases, with great recession of the spaces, and apparent danger of complete obstruction, intubation, as for diphtheritic laryngitis, should be performed.

The application of a wet, cold compress is of service in reducing the swelling of the vocal cords.

Congenital Laryngeal Stridor.

This is an obscure condition and no cause has been satisfactorily named, in the absence of pathological conditions which by pressure would cause obstruction to the larynx. Enlarged thymus gland has been found, causing pressure, the peculiar crowing sound being produced.

Symptoms.—Within a few days after birth the child is noticed to make a peculiar high-pitched crowing inspiratory sound; louder when disturbed or crying, and then associated with recession of the supra and infra clavicular spaces. The proper

oxygenation of the blood appears to occur as no cyanosis is present.

Course.—The condition tends to a spontaneous cure, a decided improvement usually occurring before the end of the first year. No treatment is of avail.

CHAPTER IX.

DISEASES OF THE EAR.

Deafness in children is much more frequently present than is ordinarily thought, and in school children may prove a serious handicap to their progress. In this period any defect in hearing will interfere with the development of speech, and inattention and slow mental development is the result. Inattention in an otherwise normal child should cause an examination to be made of the child.

Adenoids is perhaps the most frequent cause of deafness; next being nasopharyngeal catarrh, with an occlusion of the Eustachian tube and the extension of the inflammatory process to the middle ear. These children if watched at play will be seen to have less endurance, and this is exaggerated in damp, humid weather.

Every child should be examined at school for acuteness of its hearing, and in the presence of its teacher. If the hearing is found defective, an otologist should be consulted in order to locate the cause of the defect.

This is one of the many advantages which can be gained from medical inspection of schools.

EXTERNAL AUDITORY CANAL.

Furunculosis.—The most frequent condition affecting the canal is a *furunculosis* of the skin inside the meatus. This is not often seen in young children but comparatively often in those approaching puberty.

Etiology.—The practice of children putting foreign bodies in their ears is a potent factor. This causes an abrasion of the skin and an infection, usually by the staphylococcus, which in one form or another are normally found in the hair follicles

of the canal. In older children the employment of pin heads and sharp instruments to give relief from itching or to clean out the normal secretion of wax results in an infection.

Pathology.—There may be a diffuse inflammation of the skin of the entire canal, or one or more discreet furuncles. The swelling may be diffuse enough to make an examination of the drum impossible.

Symptoms.—Perhaps more pain is caused by inflammation located here than at any other part of the body, owing to the tenseness of the tissues of the canal. Pressure pain develops early, and if the furuncle is located near to the meatus movement of or touching the external ear causes pain. There may be a slight rise of temperature, to 101° F., occasionally, loss of sleep and of appetite, with general depression and irritability. Unless relieved by incision, the furuncle generally ruptures spontaneously during the first week and immediate relief is afforded by the escape of pus and blood. Unfortunately one boil may be followed by another, as it is next to impossible to keep the parts sterile after discharge of pus from the first one takes place.

The location of the boil can be made out by the use of a cotton-protected probe. A speculum cannot always be used on account of the tenderness. Mastoiditis must be differentiated from, which is chiefly done by pressure on the mastoid bone, eliciting tenderness in the latter only.

Treatment.—Abortion of the boil is possible. This can sometimes be effected by leeches applied just external to the auditory canal, care being taken to plug the canal with cotton to prevent their migration into it. Locally, cotton, saturated with a 50 per cent ichthyol and glycerine solution may be of benefit. The continuous application of heat by irrigation with a fountain syringe is of great benefit. Efforts at aborting the boil being ineffectual, an incision is absolutely necessary, and this should be made with a special furuncle knife with a triangular or a half-curved blade, and the incision made through the furuncle and the tissue on either side of it, thus draining the collection of pus and reducing the congestion also.

This operation is so painful that the administration of a general anesthetic is urged. Laughing gas is most efficient, having

the advantage of lack of after-effects, nausea, etc. If this is not available, chloroform to the primary stage should be used.

If these furuncles are recurrent the injection of the bacterial vaccines is recommended.

Local antiseptics and cleansing should constitute the after treatment, probably using irrigations two or three times a day.

IMPACTED WAX.

The natural secretion of cerumen may be increased in amount and collect in the canal, and when mixed with the epithelium of the canal may obstruct the entire meatus. The mass may be pushed inward and press against the drum. This frequently causes symptoms such as tinnitus, gradual deafness, a sense of fulness in the ear, or more or less pain, dizziness and perhaps vomiting. An examination of the ear with a good, reflected light is sufficient to make the diagnosis. At first it may resemble a foreign body in the canal.

Treatment.—The wax may be removed with a curette if close to the orifice, but frequently will have to be softened by repeated syringing with warm water in a piston syringe. The force obtained from a fountain syringe will not disintegrate the mass as a rule. The fluid used should either be plain sterile water, normal salt solution or saturated boracic acid solution.

If syringing does not succeed in disintegrating the mass, a solution can be used as follows for instilling into the ear three times a day, until the wax has softened:

R Acid carbolic	℥.i
Acid boracic	gr. xx
Sodium biborat.	gr. x
Glycerine	℥ss
Aquæ dest.	℥ss

A dry dressing of powder should be blown in the ear after the wax has been removed.

THE MIDDLE EAR.

The student and practitioner should familiarize himself with the appearance of the normal drum membrane, should be able

to locate the landmarks, as follows: The short process of the hammer; the handle of the hammer or malleus; the triangular light spot. The normal color is a pearl-gray, and abnormal conditions evidence themselves chiefly in a change of color of the drum.

Inflammations of the middle ear are either suppurative, which may or may not have been the result directly of an extension upward of an inflammation of the Eustachian tube.

ACUTE TUBOTYMPANIC CATARRH.

Etiology.—Whether the normal middle ear contains bacteria is a debatable question, equally prominent authorities holding opposite views. Bacteria may gain entrance to the tympanic cavity through an opening in the drum, the result of trauma, or through the Eustachian tube. They may obtain entrance also via the blood and lymphatics.

The most frequently observed bacteria are the streptococcus and staphylococcus; though the following may be found, the pneumococcus, the bacillus pyocyaneus, Klebs-Loeffler bacillus, the meningococcus intracellularis, influenza bacillus and the colon bacillus.

Nasopharyngeal adenoids are one of the most frequent causes of catarrhal inflammation of the mucous membrane of the middle ear. They are the most frequent cause of the so-called colds and acute coryza which so frequently precede an acute tympanic catarrh without suppuration.

Pathology.—Inflammation may rarely be limited to the Eustachian tube, but usually extends to the cavity as well. As a result of the inflammation, swelling and occlusion of the Eustachian tube there is a slight accumulation of serum and an absorption of the air in the middle ear, and a coincident inward depression of the drum membrane.

Symptoms.—The first symptom which is present is usually an impairment of hearing, followed by a sense of fulness on the affected side, ringing in the ear, perhaps dizziness. When the catarrhal inflammation extends to the middle ear there is a swelling of the mucous membrane and more or less pain.

In the early stages, when most of the involvement is in the

Eustachian tube, the drum membrane is retracted, but subsequent examinations may show a collection of fluid in the cavity.

Prognosis.—Early recognition and prompt treatment make the prognosis favorable. The restoration of a diseased condition of the nasopharynx to normal greatly influences the prognosis and limits the possibilities of a return of the condition.

Treatment.—When only the tube is involved, with more or less occlusion, it must be opened, either by the Eustachian catheter or by the Politzer bag. The catheter is entirely impractical in children, and inflation of the drum by the Politzer bag yields the best results.

First cleanse the nose and pharynx with an antiseptic spray (Dobell's solution or Seiler's solution), followed by a nebulizer.

Several methods of Politzeration are advised. The child is seated, the tip of the bag is placed well in the nostril of the affected side and held, the opposite nostril being compressed. The child is then told to count one, two, three, and as the last word is said the bag is squeezed, which usually effectually inflates the affected side. The child may be told to fill the lungs with air and forcibly to blow it out through puckered lips, the bag is then squeezed and the drum inflated. In older children

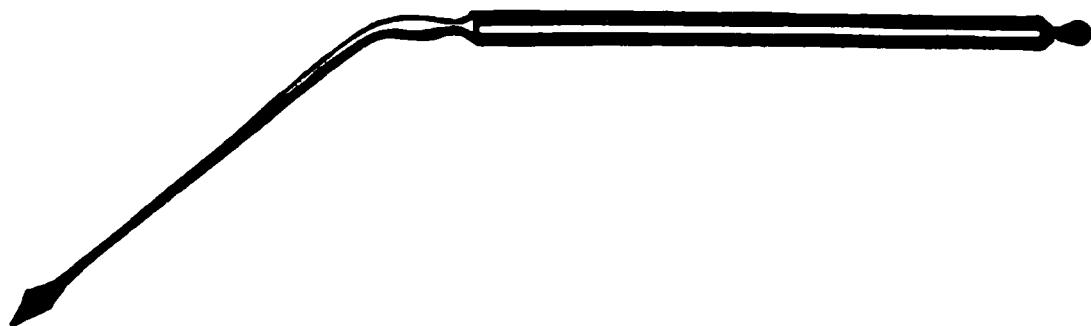


Fig. 44.—For paracentesis of the drum.

the inflation can be accomplished as a swallow of water is taken, but in younger children this is impractical because of the danger of choking.

The Politzeration should be done every day for three or four days, and then every other day, and finally once a week for several weeks.

In the presence of a collection of fluid in the cavity a paracentesis or incision of the drum should be done.

For this operation a general anesthetic should always be given as the pain is very acute. The necessity for a paracentesis rarely

exists until the patient has already suffered acutely for a number of hours, probably having lost much sleep; hence the infliction of additional acute pain should not be allowed. Local anesthetics are not of much avail. The following can be used with some benefit:

℞ Cocaine muriat gr. x
Ac. boracic saturated sol.
Alcohol aa 3i

M. Politzeration should be performed after paracentesis.

ACUTE CATARRHAL OTITIS MEDIA.

Pathology.—The mucous membrane lining the middle ear is acutely inflamed and swollen, and an exudate usually occurs, being either serous or mucous, bathing the mucous membrane. There may be an accumulation sufficient to fill the cavity.

Etiology.—While this condition may occur as a primary affection it is usually an extension of the process from the nasopharynx, any of the bacteria named in the previous section being found in the tympanic cavity. Bacteria in the nasopharynx may be forced in the cavity through the tube by nasal douches or sprays, gargling or coughing when swallowing.

As a complication in the acute exanthemata, this form of otitis is most frequent.

Symptoms.—Any severe pain in the ear is always suggestive of this form of trouble. It is at first a dull, deep-seated ache, gradually increasing in severity until it becomes sharp and lancinating; sleep is impossible, and older children walk the floor holding the affected side. Remissions in the severe pain are hardly long enough to allow the child to fall asleep, crying out with each exacerbation. Younger children usually pull at the affected side.

If old enough to tell, the watch test evidences deafness to a greater or less degree, according to the severity of the inflammation and amount of effusion. Some complain of the ringing in the ears, in others this is less noticeable.

Pain is severe until the fluid in the ear escapes, either through a spontaneous rupture in the drum or a paracentesis of the drum

is performed, when the feeling of relief is immediate and the child falls asleep.

In children there is usually a rise of temperature, from 1° to 3° F., though there may be no rise at all. As a complication of the exanthemata there is nearly always an elevation. A child may waken in the night with an earache, having previously suffered from an acute coryza, perhaps have a slight remission in the pain during the day, with a recurrence of it at night, permanent relief being had only after spontaneous rupture of the drum and escape of the mucus or serum, and all of this without elevation of temperature. This rupture may occur in 12 hours after the onset of the pain, but may be delayed for three days.

The drum membrane, if examined before rupture, is found to have changed to a deep or cherry-red color, the landmarks have disappeared, and if the exudation has occurred in the cavity the drum bulges outward in some portion, usually it being greatest in the upper, posterior portion. If the drum has previously ruptured the canal is filled with exudate, and a free view of the drum cannot be had without a previous cleansing with a cotton-protected swab.

Untreated or neglected cases of the catarrhal variety of otitis usually develop into the suppurative form, especially after a perforation of the drum has occurred. The opening in the drum from a perforation is usually found in the inferior quadrant, to the right or left.

Prognosis.—The majority of these cases completely recover. The condition of the nasopharynx influences the prognosis. Persistence of a nasopharyngeal catarrh, adenoids and anemia, tend to the likelihood of recurrence of this trouble.

Treatment.—If seen early, before there has been a perforation of the drum, an anodyne is necessary, opium in some form being most efficacious. The camphorated tincture or the deodorized tincture may be used.

The tampon in the canal, suggested by Barnhill, is of service also. A cone of cotton is twisted on the end of an applicator, saturating the end of the cotton with a phenol (10 per cent) and glycerine (90 per cent) solution, and holding it over a flame until as hot as can be stood on the back of the hand, and before

it has had time enough to cool it is removed from the applicator and carried back against the drum membrane with the end projecting from the meatus.

I have found excellent results follow the use of an irrigation of the ear with a fountain syringe, using water as hot as could be borne and holding the syringe not more than 12 inches above the head, thus doing away with the pressure against the drum. The child should be persuaded to put his hand in the water for a moment to become familiar with its temperature before it is used in the ear.

Usually before the physician has been called the mother has dropped into the ear some warm sweet oil and laudanum which, as long as it retains its heat, is effectual, but little absorption of the laudanum occurring.

Paracentesis of the drum should be performed as soon as a bulging drum has been found. This should be done under strict antiseptic precautions and in the subsequent treatment being most careful to prevent infection. Rest in bed, if fever is present; indoors, if the child is up.

An occasional dose of calomel, 1 grain at a dose at bedtime, followed by a saline the next morning; syringing the discharging ear frequently; at first, every two or three hours, daily after this; drying of the canal by cotton swabs and insufflation of canal with boracic acid powder constitute the treatment which generally yields the best results.

A sudden cessation of the discharge, an increase in or return of pain, rise in temperature, usually indicates a too early closure of the drum.

ACUTE SUPPURATIVE OTITIS MEDIA.

This form may follow the catarrhal otitis or originate as the suppurative form. A large percentage of cases of deafness are due to this variety of inflammation, and chronic otitis is a frequent ending.

Etiology.—One of the most frequent causes is bacterial invasion of the tympanic cavity as a complication of influenza. Large numbers of acute-discharging ears are seen every winter in which influenza is epidemic.

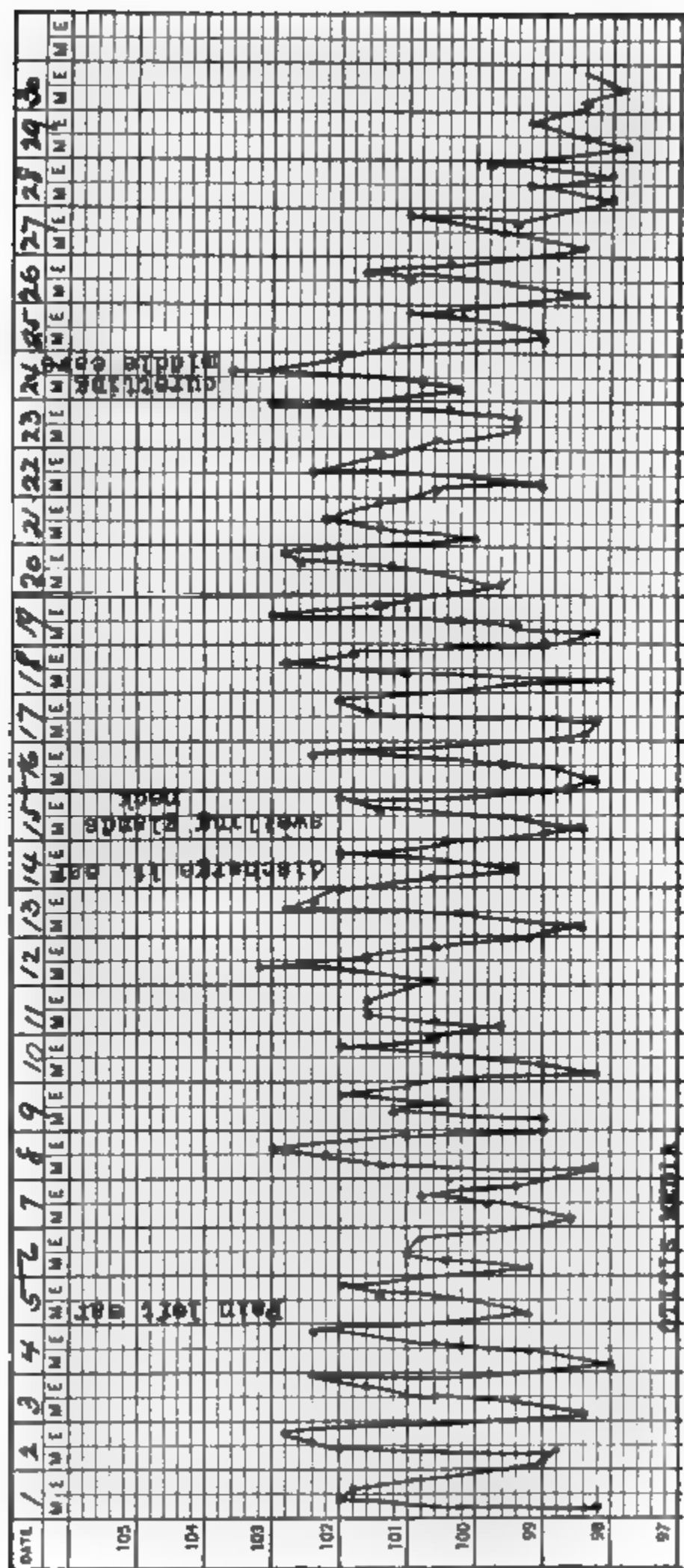


Fig. 45 --Otitis media both ears.

The exanthemata, especially scarlatina and diphtheria, are frequently complicated by suppurating middle ears. In the former disease infection of the ear most frequently follows the membranous form of angina. The streptococci are most frequently found as the infecting organism.

As in the other varieties of middle ear involvement, the presence of adenoids is an exciting factor of middle-ear suppuration.

Symptoms.—No other condition of the ear presents such a variety of symptoms as this. Some may be present with severe constitutional and local symptoms, as a temperature ranging from normal to 103° or 104° F., severe prostration, deafness and agonizing pain in the ear. In others one of the first symptoms will be the discharge from the ear following, perhaps, a sense of discomfort or fulness in the affected side.

It is usual, however, for the trouble to be ushered in with severe pain, deafness, tinnitus, perhaps vertigo or dizziness.

The accompanying chart is of a patient three years of age who presented but few symptoms before the discharge began, and practically none afterward, except the temperature, loss of appetite and some loss in weight. The discharge was profuse, and when the opening in the drum became slightly closed, causing retention of secretions, all of the symptoms were aggravated.

When occurring as a complication in the exanthemata there is usually a rise in the temperature, especially if the suppuration occurs late in the course of the disease, as may be the case.

Usually with the rupture of the drum the pain subsides immediately, and the child is free from pain unless the opening becomes blocked with discharge, when pain is again severe. Where the child has been previously restless and crying, as soon as the rupture takes place it falls into a peaceful sleep. It is astonishing to see the amount of discharge which may come from the middle ear. It is usually thick and yellow, caking in flakes upon the ear and beneath when it is profuse enough to run over.

It is impossible to state the character of the secretion in the middle ear by the looks of the drum membrane, though in the suppurative form there is apt to be a larger amount, hence more bulging. The membrane is reddened, more or less uniformly,

except at the site of the rupture, which may be imminent, this showing signs of necrosis by change in color.

The opening in the drum as a result of a spontaneous rupture may vary from a slit to a practical washing away of the entire drum.

The tendency in the former variety of opening is to too readily heal, closing before the discharge has ceased.

Prognosis.—The earlier this condition is recognized and properly treated the better the chances of recovery with normal hearing. Continuance of fever and other symptoms after discharge has begun indicates an involvement of deeper structures as the mastoid and the brain.

Untreated cases develop into a chronic condition with continuous discharge, washing away of the entire drum, frequently evacuation of the ossicles and permanent deafness.

Treatment.—The indications for treatment as soon as diagnosis is established are very clear; prompt and efficient drainage should be established as early as possible, and maintained, and extension of the inflammatory process stopped if possible.

The local application of heat, continuous irrigation with hot saline solution for 10 or 15 minutes, or perhaps the administration of an anodyne may be needed for the relief of the pain. In some cases leeches can be employed with advantage, but the child should not be allowed to see them or told what is being done when they are applied. As soon as a bulging of the drum has been diagnosed a free incision should be made, and, as suggested in the previous section, this should not be done except under a general anesthetic. It is a most painful operation; a view of the drum cannot be satisfactorily obtained without it, and if done without, and great pain caused, the child will be intolerant of examination and treatment for years afterward. Early evacuation of the pus by paracentesis limits the chances of extension of the process to deeper structures from pressure of the pent-up secretion.

Frequent examination of the drum should be made after paracentesis to note the changes occurring in the drum, the tendency of the opening to close, etc.

The patient should be confined to bed during the active stage

of inflammation. The child should have a pledget of cotton in the external auditory canal and a pad of gauze covering the entire external ear, this confined by a bandage over the head.

Lying with the affected side down is a great aid in drainage. Frequent irrigation is of great benefit, at least every three hours at first.

The following table given by Barnhill gives excellently the differential diagnosis of the three forms of trouble just described:

DIFFERENT DIAGNOSIS OF ACUTE TUBOTYMPANIC CATARRH, ACUTE CATARRHAL OTITIS MEDIA, AND ACUTE SUPPURATIVE OTITIS MEDIA.

<i>Acute Tubotympanic Catarrh.</i>	<i>Acute Catarrhal Otitis Media.</i>	<i>Acute Suppurative Otitis Media.</i>
PAIN.		
Absent in the ear; usually amounts only to a sense of soreness in throat, as of foreign body. More or less pain along course of Eustachian tube.	Severe in depths of the ear, radiating over side of head. Worse on lying down. Pain increased by blowing nose or coughing.	Very severe, of lancinating, tearing variety. Increased by recumbent position, by coughing, sneezing, blowing of the nose, etc.
FEVER.		
Absent, unless the tubotympanic catarrh is secondary to some other ailment as a mild form of measles, which primary disease gives rise to the fever.	Temperature usually elevated, 100° F. in infants and young children.	Ranges from 102 to 104° F., the height of temperature depending much upon the presence of some general disease, as measles, scarlet fever or la grippe.
DEAFNESS.		
Moderate. Patient complains of great deafness, however, largely because of the suddenness of onset.	Very considerable in affected ear.	Very great in affected ear. Patient very deaf when both ears are involved.

PROSTRATION OF PATIENT.

None.	Usually moderate. Sometimes considerable.	Often very great.
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TINNITUS, VERTIGO, ETC.

Present and often severe.

Head noises not a prominent symptom except in later stages, after the pain and fever have subsided. Vertigo and nausea rare.

If present in beginning are so masked by severe pain that they are not mentioned. Sometimes present during convalescence.

DRUM MEMBRANE.

Greatly retracted in first stage, less so in second stage. Inflammation absent, vessels along handle of malleus sometimes injected. After exudation into the tympanic cavity has occurred, a dark, or sometimes a light line may be seen crossing membrane, and indicating level of fluid. All landmarks present.

Little or not at all retracted at onset, later is bulging over some quadrant. Injected at first, and later a diffuse, uniform redness covers whole membrane. Landmarks usually all obliterated with possible exception of short process of the malleus.

Intensely reddened, especially in upper portion; swollen, bulging, opaque. Landmarks all obliterated. Drum membrane may be largely destroyed during first two or three days.

PERFORATION.

Drum membrane seldom ruptured.

Drum membrane usually perforated after from one to three days.

Always present after two or three days.

DISCHARGE.

None except after paracentesis.

Thin, seromucous discharge immediately after rupture or paracentesis. May later become purulent from infection.

Sanguinopurulent at moment of perforation, purulent later. Usually very profuse.

TYMPANIC CAVITY.

Rarefied in first stage. In second stage frequently contains a yellowish serum, or ropy, mucoid exudate, which is visible through non-inflamed membrana tympani.

Contains seromucous exudate, which bulges membrane, but is not visible through inflamed membrane.

Contains pus. Mucous membrane greatly swollen, with necrotic areas in worst cases. Incus and hammer sometimes carious.

TYMPANIC INFLATION.

Not painful. Immediate and marked improvement results to hearing.	Painful. Little or no improvement in hearing except in later stages.	Painful and should seldom be performed during height of inflammation.
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HISTORY.

Usually accompanies or follows a cold in the head or a naso-pharyngitis. May result from mild attacks of exanthemata or tonsillitis.	Accompanies or follows the exanthemata of moderate severity, and the acute tonsillar and naso-pharyngeal inflammations.	Follows or accompanies the more violent forms of the exanthemata, la grippe, ulcerative tonsillitis, diphtheria, etc.
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MASTOID COMPLICATION.

Never occurs.	Seldom occurs.	Frequently occurs.
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MASTOIDITIS.

The mastoid is but poorly developed in young infants, and fortunately not so very frequently involved as later in childhood.

Etiology.—Probably less than 1 per cent of cases of mastoiditis develop without being secondary to acute suppurative middle-ear disease. Neglected cases of suppuration with long-retained pent-up secretion in the middle ear makes infection of the mastoid cells an easy matter.

Diagnosis.—This is not always easy, and many factors influence one in a diagnosis. It should be suspected in all cases of severe and prolonged suppurative, middle-ear cases. Constitutional symptoms are apt to be more severe upon the development of mastoiditis, temperature more elevated, pain more acute, with swelling and tenderness over the mastoid.

Symptoms.—A previously free discharge may cease or become much lessened, the temperature usually rises quite high, 104° F. or 105° F., or there may be a very little rise, if any. The pain or discomfort and tenderness are quickly located behind the ear, which is shortly followed by a swelling of the skin just back of and slightly below the middle point of the back of the ear. "A sagging of the posterior superior meatal wall" has been suggested as a fairly constant occurrence. There is much restlessness and disturbed sleep.

Prognosis.—This condition is an extremely serious one and causes great anxiety on the part of the physician or specialist in charge. The decision as to employment of surgery is difficult to make and requires keen observation and careful consultation. Possible meningeal involvement in children should always be borne in mind.

Treatment.—Local application of cold over the affected mastoid by cloths, small ice bags or specially-devised ear ice bags is first indicated, or the opposite, heat, may be equally effective in reducing inflammation and easing pain. Sedatives may be positively necessary but should be used with great caution and conservatism. Leeches to the affected side may be serviceable if applied early in the involvement.

As before stated, just where the medical treatment fails and surgery is indicated is a fine line not easily differentiated, and a safe rule to follow, is when in doubt operate.

A competent specialist should always be associated with the practitioner in these cases.

CHAPTER X.

DISEASES OF THE EYE.

Eyestrain.—The prevalence of eyestrain in school children is but little appreciated by teachers, parents or physicians. The eyesight should be systematically tested in all school children by a medical examiner, and the parents of those found deficient notified and requested to have the defect corrected.

Statistics of different observers¹ show from 30 to 50 per cent of several thousand school children, systematically examined, to have visual defects, who could use glasses for close work with benefit to their eyes. It was found an average of 11 per cent of school children wear glasses. Investigation in 20,000 cases showed that 7.3 per cent of all children suffer from 6/18 or worse defective vision. Of the various errors of refraction the following table shows the result in 2500 Philadelphia school children of all grades:

	<i>Per cent.</i>
Emmetropia	11.19
Hyperopia, simple 31.23 per cent	}
with Astigmatism 42.81 per cent	
Myopia, simple 2.68 per cent	}
with astigmatism 11.02 per cent	
Mixed astigmatism	1.07

Headache, fatigue, inability to concentrate the attention or to study result from eyestrain, and a careful examination should be made in all cases.

BLEPHARITIS.

Definition.—An inflammation of the margin of the lids which is quite frequent in children.

Etiology.—An infection of the hair follicles is usually the beginning of the process. The *squamous* and *ulcerative* types are

¹ Cornell: Monthly Cyclopedia of Practical Medicine, March, 1908.

recognized. Predisposing causes are eyestrain, dust and smoke which result in a congestion of the mucous membrane of the lids. The exanthemata, tuberculosis, anemia and a general run-down condition also predispose to it. It is usually found in connection with conjunctivitis, both catarrhal and phlyctenular, and often with eczema of the face. ²

Symptoms.—In the milder form there may not be many focal symptoms beyond a scaliness of the edge of the lids, which carry away a few hairs when brushed off. In acute cases there is a burning and itching sensation of the margin of the lids and some photophobia; after a duration of some days the edges of the lids are much congested and swollen and bathed in a thick yellowish secretion.

Treatment.—In the squamous form after removal of the scales, which can be accomplished by washing with an alkaline solution and soap, or softening with vaseline, the local treatment can be begun. The following can be used to advantage:

R Hydrargyri oxidi flav. gr	viii
Vasellini	ʒi
M. ft. ung.	

In the ulcerative form they may need the application of a 1 or 2 per cent solution of nitrate of silver after removal of concretions. Generally a tonic treatment is indicated with proper hygienic surroundings.

HORDEOLUM.

Synonym.—*Stye*.

Etiology.—An infection of one of the glands of the eyelid or an eyelash follicle takes place from an invasion of the staphylococcus aureus or other pus-producing organism. As a result of the inflammation suppuration takes place, and frequently a reinfection results with a succession of them. As predisposing cause, blepharitis marginalis is perhaps the most frequent. Eyestrain is also a predisposing cause.

Symptoms.—Pain of a stinging or smarting character and edema of the lid precedes the development of the stye. The “pointing” of the abscess is usually at or near the lid margin,

and it may rupture spontaneously or necessitate an incision to evacuate the pus. The pus is usually quite thick and stringy in character.

Styes may develop in quite young children, and when it is considered how possible it is for an infection to take place in the child as it plays upon the floor and rubs its eyes with its fists it is a wonder they are not oftener seen. I have recently seen one in an infant of six months.

Treatment.—The abortive treatment is occasionally successful, viz.: Cold applications and pulling out a lash when root is infected, or the application of a 30-grain-to-the-ounce solution of sulphate of zinc. If the upper lid is affected, it is pulled down over the lower lid and the solution painted over its edge with a cotton-covered match or tooth pick. The solution is not allowed to touch the conjunctiva of the eye. The applications are repeated several times during the day.

The injection of carbolic acid to abort the boil cannot be even considered in the child.

If a blepharitis marginalis is present the use of a yellow oxide of mercury ointment (gr. ii to 5i) may bring about a cure promptly enough to prevent a styne from forming.

If the edema continues and the collection of pus does not take place quickly, much relief can be had by the application of poultices, small squares of flannel wrung out of hot water and laid over the affected eye. As soon as pus formation is assured, it should be evacuated with a triangular knife. The hot applications should be continued while there is a free flow of pus, and this followed by the yellow oxide ointment.

CONJUNCTIVITIS.

Two varieties may be seen, *simple catarrhal conjunctivitis* or the *epidemic* or *contagious conjunctivitis*, the latter being called *pink eye*.

Etiology.—This is due to the invasion of the conjunctivæ with bacteria, the pneumococcus and the Weeks bacillus being most frequently the cause. Bacteria-laden dust may be the active cause. Common use of towels is a frequent manner of dissemination.

Symptoms.—The *simple* catarrhal form is much milder in all its symptoms, and in its duration also. There is a burning and smarting of the eyes and lids, and a feeling as if something were in the eye and that lids must be rubbed frequently. There is early and profuse lachrimation, and the lids are stuck together when the child awakens.

In the *acute* form there is an injection of the entire conjunctiva and the lid mucous membrane is frequently much swollen. When the lids are everted the conjunctival surface will be found covered with mucus or muco-pus. It is rare that only one eye is affected.

Treatment.—Much can be accomplished by local treatment. The eyes should be irrigated four or five times daily with a warmed 3 per cent solution of boracic acid, and one or two drops of the following solution dropped into each eye three times a day:

R Zinci sulphatis	gr. ss
Acidi boracici	gr. x
Aquæ comphorat.	
Aquæ destillat.	āā ʒss
M. ft. sol.	

A mild boracic acid ointment is rubbed into the lids each night or before the child is put to sleep during the day in order to prevent the troublesome matting together of them.

Argyrol in 10 or 12 per cent solution can be used if the secretion is profuse and purulent. In the severer cases the application of cold compresses is most helpful and soothing.

Protection from strong light and winds should be insisted upon also, and no reading indulged in.

TRACHOMA:

Synonyms.—*Granulated Lids; Granular Conjunctivitis.* A chronic infectious, inflammatory condition of the palpebral conjunctiva, with the formation of oval masses in the membrane.

Etiology.—This disease is much more frequent in children, though no age is exempt. Unhygienic surroundings, filth and improper food predispose to it. The specific organism has not been isolated, though a small *double coccus* has been described

by Sattler, and a *fungus* by Muttermilch. The latter has been termed *microspora trachomatorum*. Indiscriminate use of the same towel, especially at school and in institutions is one of the ways this is spread.

Pathology.—At first there is a minute granular hypertrophy of the mucous membrane of the lid conjunctiva without involvement of the eye conjunctiva or cornea. There follows a deep injection and thickening of the mucous membrane and development of the larger granular masses or follicles, which are miniature lymph glands. After a varying length of time the stage of

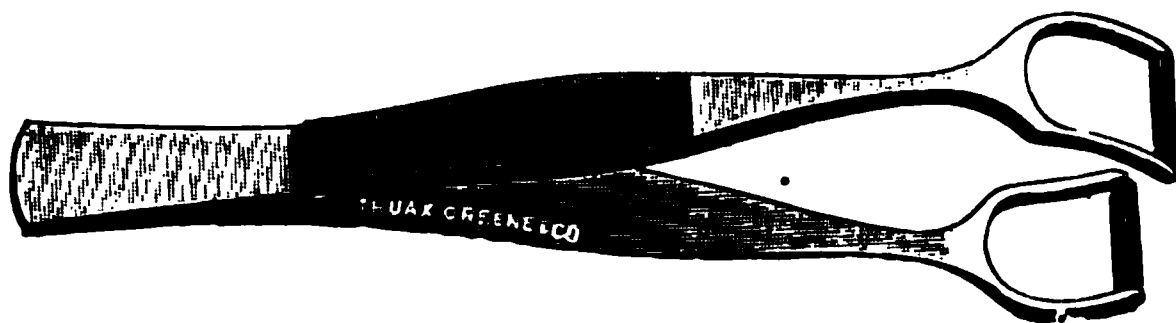


Fig. 46.—Roller forceps for trachoma.

cicatrization follows. The granules coalesce, small cicatricial bands appear, the area of conjunctival surface is less, the roughened lids scrape the eye and ulcers of the cornea form. Trachoma occurs with rarity in the negro.

Symptoms.—During the first of the granular stage there may be no symptoms. There is little or no discharge, and the lids do not adhere in the morning. After the granules have formed there is pain in the eyelids and a feeling as if sand were in the eyes, discharge is profuse, mucopurulent in character, photophobia is present and swelling of the lids takes place. At this time the ocular conjunctiva becomes injected. The lids are everted with difficulty owing to the swelling of the mucous membrane. These acute symptoms may subside spontaneously, and the condition develop into a more or less chronic one, with slight lachrimation and mucopurulent discharge. The glands at the angle of the jaw and behind the ear may become enlarged.

Prognosis.—Even under proper treatment the prognosis is not very good. It is essentially a chronic condition, relapses are frequent, even in the apparently cured.

Sequelæ.—*Opacities and pannus of the cornea; entropion and ectropion; distichiasis and symblepharon.*

Treatment.—*Prophylaxis* is of the greatest importance. In institutions, children with trachoma should be quarantined. Shower baths should be installed in all institutions, as the bathing of several in one tub, as frequently will occur if tub-bathing is practiced, may be the cause of its dissemination. Individual towels, handkerchiefs and beds should be insisted upon.

Since the introduction of the newer silver salts, protargol has been recommended as giving good results in the acute stage. Every other day a 40 per cent solution is painted over the diseased surface, and a 10 per cent solution instilled into each eye twice daily. Other remedies suggested are the following: Solution of bichloride of mercury (1:5000) painted on the lids and 1:15,000 as eyedrops; formalin (1:3000), and the application of sulphate of copper crystal direct to the diseased surface.

Surgical treatment consists in the use of the roller forceps, under general anesthesia.

GRANULAR CONJUNCTIVITIS.

A much milder form of conjunctivitis than trachoma may be encountered in which there is a deposit of very fine granules in the conjunctiva.

The symptoms and course are much less severe, and the duration shorter.

Treatment.—The response to treatment is usually much more prompt in this variety. The silver salts are efficient and bring a speedy cure if properly applied. They are used the same as in trachoma.

VERNAL CATARRH OF THE CONJUNCTIVA.

This form of conjunctivitis has recently been recognized by the authorities.

It is frequent in children during the summer months, and consists of a lymphoid hypertrophy of both the palpebral and ocular mucous membrane, and especially around the cornea.

It is intractable, has a tendency to recur and passes away, often uninfluenced by treatment, as the summer heat disappears.

DIPHTHERITIC CONJUNCTIVITIS.

Etiology.—The Klebs-Loeffler bacillus is the cause of this form of conjunctivitis, but it rarely exists alone, being complicated by other pus-producing organisms, especially the streptococci and staphylococci.

Pathology.—The process in the conjunctiva as the result of the invasion of the Klebs-Loeffler bacillus is the same as in other mucous membranes. The formation of the pseudomembrane occurs within 24 hours after the first congestion. The superficial epithelia are destroyed and the pseudomembrane dips down into the conjunctiva, leaving a bleeding surface when it is detached. The ocular conjunctiva may be involved in the same process.

Symptoms, Focal.—There is a great swelling of the mucous membrane of the lids, with intense congestion. Lacrimation is not profuse at the first, the discharge is thick and blood tinged. Later the discharge becomes thinner and purulent. The pseudomembrane forms in 24 or 36 hours. Bacteriologic examination may be needed to determine the exact nature of the condition.

General.—The child looks sicker than in any of the other conjunctival inflammations. There is an elevation of from 2° to 5° F. in the temperature.

Treatment.—As soon as a pseudomembrane is seen 2500 to 3000 units of antitoxin must be administered, without waiting for the result of the bacteriologic examination. The same rules obtain here as to the second dose of antitoxin as in pharyngeal or tonsillar diphtheria.

For great ecchymosis, cold application to the lids, and nitrate of silver solution, 1 to 1.5 per cent, to the conjunctivæ after the removal of the membrane.

Ulcer of the cornea is to be feared if the swelling of the lids is marked and pressure very great.

PHLYCTENULAR CONJUNCTIVITIS.

Synonyms.—*Scrofulous conjunctivitis; eczematous conjunctivitis.*

Etiology.—As indicated in the name given this disease, a

marasmic, tubercular or otherwise debilitated condition, predisposes to this form of conjunctivitis. It also follows or complicates blepharitis marginalis; acute conjunctivitis, eczema of the face or lids. The staphylococcus aureus has been found in the fluid of the phlyctenule. It rarely occurs in adults.

Pathology.—The phlyctenules are nodules on the conjunctiva or cornea, formed by an accumulation of small cells on the basement membrane and pushing up the superficial epithelial cells. An enlargement of the blood vessels occurs and they radiate, spoke-like, from the phlyctenule. The surface of the phlyctenule or nodule softens and the contents escape, leaving a small ulcer on the conjunctiva or cornea.

Symptoms, Focal.—The principal symptoms are lacrimation and photophobia. There is some discharge which runs down upon the cheek and may cause an eczematous condition there. A nasal catarrh is present also. There is usually a characteristic pose in these cases, the child burying its face in the neck of mother or nurse, or holding eyes in bend of elbow. The appearance of the eye is described under pathology.

General.—The child looks run down, is pale and anemic, tongue is coated, and the digestion may be upset.

Treatment.—If the injection of the conjunctiva is very great a solution of atropia, 1 or 2 grains to the ounce of 50 per cent boracic acid solution, may be instilled. An application of the yellow oxide of mercury ointment (gr. i to 5i) is made once or twice daily. A piece of the size of the end of a match is put between the lower lid and eyeball and the lid closed. Dry calomel may be applied to the ulcer with advantage when it forms.

Generally, a tonic is always indicated in these cases. A solution of the hypophosphites, glycerophosphates or cod liver oil will be of benefit.

The diet should be regulated and much fresh air insisted upon. Study and use of the eyes should not be allowed. Dark glasses in the older cases will give great comfort.

OPHTHALMIA NEONATORUM.

Etiology.—Due to the entrance of the gonococcus into the conjunctival sac during the passage of the head through the cervix and vagina. The colon bacillus or the pyogenic organisms may be the cause of a milder inflammation. If it occurs in later life it is caused by the accidental inoculation of the eye with the gonococcus.

Prophylaxis.—The instillation into each eye of 1 drop of a 2 per cent solution of nitrate of silver, as advocated by Credé, followed by an irrigation of normal salt solution, will prevent ophthalmia. Its use should be universal and not reserved for those children whose mothers are suspected of having a specific vaginitis at the time of the labor.

For those who prefer a substitute for the nitrate of silver, because of fancied irritation following its use, a 10 per cent argyrol solution is recommended.

Focal Symptoms.—Usually on the second or third day the lids of one or both eyes are stuck together, and when separated a profuse discharge escapes. The discharge is distinctly purulent and may run down on to the cheek. The lids rapidly become swollen and the mucous membrane intensely congested, making it difficult to evert them. If the secretion remains pent up between the lids an ulceration of the cornea may result.

Great pain evidenced by crying and restlessness is present; there is marked photophobia, and unless the hands are pinned down the eyes will be rubbed.

Prognosis.—This form of inflammation is one of the most serious to be encountered. More cases of blindness result from a specific conjunctivitis than any other. Magnus reports that 24 per cent of inmates of institutions for the blind in Europe have lost their sight from ophthalmia, and statistics show an equal or greater number in this country. Upon prophylaxis, and promptness of treatment alone, success depends.

Sequelæ.—In the severe cases, as a sequence, the following conditions may be found: Anterior staphyloma; ulceration and necrosis of the cornea leaving an opacity which may seriously impair vision; or an anterior synechia.

Case.—In one of the few cases in my experience in which I failed to employ the Crede method of prophylaxis, an ulceration of the cornea in both eyes followed a severe ophthalmia and an evacuation of the contents of both globes. In this case, an institution one, the silver was not used, as the bottle containing the solution was turned over and its contents lost. When it was used the next morning it was too late, as evidences of inflammation were present. This one unfortunate case has been a constant reminder to use the silver in the eyes of every new-born baby.

Treatment.—Good results can be had only by beginning the treatment promptly; the treatment must be not only unremitting but intelligently prescribed and administered. To verify the diagnosis a smear of the purulent discharge should be made upon a slide, stained with methylene-blue and examined for the gonococcus. As the symptoms are so rapid in development the beginning of the treatment should not wait upon the microscopic report.

A day and night nurse should be employed. The eyes should be irrigated with a boracic acid or normal salt solution once every hour in the 24. The first thought, if only one eye is affected, should be to prevent the infection of the other. The child lying upon the affected side with face held over a basin, the solution is directed into the inner canthus of the affected eye, with the lids opened as far as it is possible. This irrigation should be gently done to avoid abrasion of the cornea, and the fountain syringe not held over 12 inches above the head.

Between the irrigation, unless the secretion is thin and watery, the eye is kept covered with ice cloths. Cotton goods is cut into 1-inch squares, and these are kept attached to a block of ice in a basin near the bedside. As they are removed from the eye they are destroyed and fresh ones applied every 15 minutes. This treatment has been objected to by some as it is thought to be impracticable to apply the cloths effectively, but they are of the very greatest benefit when properly applied.

Silver solution in some form must be applied, nitrate of silver in a 2 per cent solution, or argyrol or protargol in a 40 per cent solution, once daily. It is claimed for the latter

solutions that they are more penetrating than the nitrate. The nitrate can be used in the morning and a weaker solution (10 to 20 per cent) of argyrol two or three times during the day.

If it is possible to do so the solution should be applied to the everted lids by a cotton swab, but this may be impossible on account of the great swelling of the lids. In this event the solution should be instilled as thoroughly as possible.

To evert the eyelids of a child Vail¹ recommends the following method:

The surgeon sits with the child's head lightly clamped between his knees, the child's body in the lap of the nurse, sitting close by in a chair, and the child's hands held by the nurse. The feet are allowed to kick free. The entire finger nail of the left index finger is placed on the lower lid and the finger crooked so that the pulp of the finger tip will just override the edge of the lower lid; then the upper lid is gently pushed downward by means of the index finger of the right hand, placed at the upper tarsal rim, until the free border of the upper lid overrides the pulp of the finger tip of the left index. Maintaining the pressure with the right index finger when this position is affected, the upper lid is turned inside out by simply keeping the free edge of the upper lid against the pulp of the index finger of the left hand. The right hand is now free to use in everting the lower lid. Having everted the upper lid, the lower is easily everted by making pressure downward with the right thumb.

The protection of the sound eye by a watch crystal held in place by adhesive strips has been recommended by Buller, and in older patients is practical. The hands of the infant should be held down by pinning the sleeves to the front of its dress.

Regularity of feeding and tonic treatment, if case is prolonged, is recommended.

PTERYGIUM.

This is an uncommon condition in children. It consists of a circumscribed hypertrophy of the conjunctiva, quite regularly triangular in shape, containing enlarged blood vessels, and the

¹ Journal of Ophthalmology and Otolaryngology, December, 1907.

apex of the area pointing toward the cornea. The vessels enter at the base.

Etiology.—Two varieties are usually described, *psudopterygium* and *true pterygium*. In the first, the condition seems more like a formation of cicatricial bands following a violent inflammation such as a gonorrheal or diphtheritic conjunctivitis, or trachoma. The latter form has been ascribed to the long exposure of the eyes to heat, or the sun's rays, as on the water, wind, dust, etc.

Symptoms.—These growths usually occur on the nasal side of the eyeball, though the whole horizontal, central area of the ball may rarely be involved. The growth gives practically no pain or inconvenience, but is very unsightly.

Treatment.—Surgery offers the best results, and excision is the best method of dealing with it.

DISEASES OF THE CORNEA.

Phlyctenular Keratitis.

Etiology.—The same conditions causing phlyctenular conjunctivitis cause a phlyctenular keratitis, and, in fact, they usually occur simultaneously. It occurs most frequently between the ages of 2 and 12 years.

Symptoms.—The same symptoms that are present in phlyctenular keratitis; the photophobia and lacrimation are more severe. According to the location of the ulcer is the sight affected. If over or near the pupil the sight may be greatly impaired, owing to the opacity of the cornea. The pose referred to in the description of the conjunctival variety is more constantly maintained. The eyes may have to be forced open for inspection because of the photophobia. Lacrimation is profuse, and mucopus is present in most of the cases. When one or more phlyctenules are seen at the margin of the cornea, overlapping both the cornea and conjunctiva, they are called *marginal phlyctenules*.

Treatment.—Atropia instilled into the eye is very necessary, using, perhaps, a slightly stronger solution (gr. ii or iii to $\bar{5}$ i). The same strength of yellow oxide of mercury ointment is of

value in this form. Boracic acid irrigations should be used three or four times a day. A general tonic treatment is also indicated. The photophobia may often be overcome by immersing the face in a basin of cold water for a few seconds several times a day.

Interstitial Keratitis.

This is the form of inflammation of the cornea first described by Hutchinson as occurring in congenital syphilis. It occurs generally in children, and is most frequent between 5 and 12 years of age. It is generally bilateral.

Pathology.—There is an inflammation and infiltration of the cornea with formation of fine blood vessels deep in the corneal tissues, and an injection of the conjunctiva. The infiltration is uneven. There may be an opacity of the entire cornea. If recovery takes place there may remain some fine lines running through the cornea, which were the former vessels.

Symptoms.—There is lachrimation and photophobia but not much pain. Sometimes there is a spasm of the lids. Associated with this disease are the peculiar notched or Hutchinson teeth; the skin lesions occurring in syphilis; the facies, and labyrinthine deafness.

The duration is chronic, recovery rarely occurring sooner than two or three years. Atropia is of great help in obtaining comfort and should be used for its effect two or three times daily in solution 3 to 4 grains to the ounce. In the very acute stage the patient may have to be placed in a dark room, but usually comfort can be had by use of dark glasses. Application of hot cloths is of great comfort, in presence of spasm of the lids. Difference of opinion exists as to the value of yellow oxide of mercury ointment. It should be used only when the severe inflammatory symptoms have subsided, and in connection with massage is of benefit.

In the acute inflammatory stage atropin is used with the hot applications on account of the probability of an iritis developing.

Internally mercury is indicated early and late and continuously for a number of weeks. Iron and cod liver oil are also important, in connection with good food.

CHAPTER XI.

DISEASES OF THE RESPIRATORY ORGANS.

FOREIGN BODIES IN THE RESPIRATORY TRACT.

Owing to the frequency with which children place foreign bodies in the nose and mouth, the comparative infrequency of the aspiration of these bodies in the bronchial tubes is to be wondered at. Any small body may find its way into a bronchial tube, as a glass bead, a pea or bean, a pebble, etc.

Symptoms.—A child while at play, usually entirely well, is seized suddenly with a paroxysm of coughing, followed by dyspnea, which may be quite severe, there being a decided blueness of the face. If the object is of sufficient size to obstruct the larynx the child will succumb from asphyxiation; if it lodges in a bronchus, there may be no more than frequent repetition of the paroxysmal coughing. Owing to the large size of the right bronchus, and the angle at which it arises from the trachea, the bodies usually lodge on this side. An X-ray examination may be necessary to locate the body, provided it is of the nature which will show upon the negative.

Physical signs may aid the diagnosis. If the obstruction is complete there is absence of the respiratory murmur and voice sounds on that side, though at first there may be resonance due to the retention in the vesicles of the air in the lung at the time of the obstruction. This air is soon absorbed and dulness is found over the entire lung.

Owing to the irritation and bacterial invasion a broncho-pneumonia is very liable to develop, or a localized abscess.

Diagnosis.—With the history detailed above, the aspiration of a foreign body should always be suspected. The presence of a paroxysmal cough of very sudden onset without previous coughing is suggestive. A diagnosis from whooping-cough must be made, which should be easy, as whooping-cough does not begin as suddenly.

Treatment.—If the diagnosis is made as soon as the aspiration occurs it may be dislodged by quickly grasping the child



Fig. 47.—Five-cent piece in esophagus. (Reproduced through courtesy of Dr. Edward Bruce.)

by the feet, suspending it inverted and shaking it. If not at once thrown off the spasm produced in the glottis prevents its expulsion.

If the foreign body can not be dislodged by the above procedure, it should be taken to a hospital, and the X-ray picture made as it furnishes a very valuable guide to the operator.

The success obtained by the direct inspection of the trachea and bronchi by specially devised instruments for the removal of foreign bodies in the bronchi is remarkable.

Killain and Jackson have devised most ingenious and useful instruments for direct laryngoscopy, tracheoscopy and bronchoscopy, which with the skiagraph as a guide, and direct illumination, enables the operator to see the foreign body and with specially designed forceps it is grasped and removed.

Jackson gives the following measurements of the tracheo-bronchial tree:

		Child	Infant
Diameter	trachea	8-10 mm	6-7 mm
Length	"	6 cm	4 cm
"	Right bronchus	2 cm	1.5 cm
"	Left "	3 cm	2.5 cm
"	Upper teeth to trachea	10 cm	9 cm
"	Total to secondary bronchus....	19 cm	15 cm

ASTHMA.

Bronchial asthma is comparatively infrequent in infancy, though not uncommon in childhood.

Etiology.—In this condition there is a vulnerable area of mucous membrane and an abnormally sensitive nerve center and an irritant as the active causative factor. The vulnerable area of mucous membrane may be in the nares, adenoids, the bronchi, or the gastrointestinal tract.

Symptomatology.—The attack is not unlike that seen in the adult. It may be preceded by a rhinitis or a bronchitis or an attack of acute indigestion with or without vomiting. There is decided dyspnea, increased in the recumbent posture. There is difficulty both in inspiration and expiration, with a frequent tight cough, there is an anxious expression and the skin is moist with more or less cyanosis, according to the amount of obstruction to the breathing.

Physical Signs.—*Inspection* shows the extraordinary muscles of respiration being called into play, recession of the suprasternal, supraclavicular and intercostal spaces, with more or less cyanosis

or lividity. On *palpation* rhonchal fremitus may be felt if there is much spasmodic condition of the larger tubes. On *auscultation* widely distributed dry rales, sonorous and sibilant, are heard on both inspiration and expiration with occasional moist rales in the larger tubes. Coughing may dislodge the mucus causing the moist sounds, or the point of intensity of these may be changed. There is hyperresonance on *percussion* due to the temporary emphysema present.

Treatment.—Prophylaxis is of great importance. Each case should be carefully studied and the exciting cause or causes determined and removed or remedied. The nose and nasopharynx should be rendered as normal as possible, adenoids and abnormal tonsils removed, the digestion, and stools closely watched. All the methods for the prevention of bronchitis should be used, fresh air especially when the child is asleep, cool sponge baths after the cleansing bath, followed by brisk friction.

For the relief of the spasmodic condition during the attack, it may be necessary to resort to hypodermic medication; three to five minims of a 1:1000 solution of adrenalin chloride has been used with much success; nitroglycerine or occasionally when all else fails, a very minute dose of morphine. By the mouth ipecac or antimony and ipecac (āā gr. 1/100) cough tablets frequently afford much relief.

ATELECTASIS, PULMONARY COLLAPSE.

This is a condition in which a lobule or lobe of the lung is collapsed. It is principally found in new-born infants, though a collapse may occur at any time.

Etiology.—A plug of mucus inhaled by a new-born with its first inspirations may lodge in a bronchus leading to an alveolus and completely shut off the air from this part, followed by a collapse of that portion. The same condition may occur in bronchitis in later life, or after the aspiration of a foreign body into a larger bronchus.

Pathology.—There is a collapse of the alveoli of the lung, and may be limited to a small area singly or scattered through the lung. The affected areas are like liver in appearance, and

are depressed below the general surface of the lung. There may be small areas of emphysema surrounding them.

Symptoms.—In the new-born there may be no physical signs or symptoms by which the condition can be recognized early. Later, if extensive, there is a sinking in of the chest on that side, or if scattered there may be no evidence of the condition except an impairment of the breath sounds over the affected area, with localized dulness, perhaps.

In late cases, and extensive collapse, absence of breath sounds, harsh breathing, dulness and collapse of the chest wall are diagnostic points.

Treatment.—The prompt removal of mucus in the nasopharynx of the new-born will prevent its aspiration into the bronchi, inversion of the child and obtaining free inspiration and crying aids in the dilatation of the bronchi and dislodging of dry mucus which may have been aspirated.

In older children, when it follows bronchitis, a dose of ipecac for its physiological effect, the mucus being dislodged during vomiting, is efficient in dislodging obstructing plugs. Frequent spanking to make it cry and cause deep inspiration; alternate hot- and cold-baths, for the effect of causing a shock to the skin, cause deep inspiration.

ACUTE CATARRHAL BRONCHITIS.

This is an inflammation of the mucous membrane of the bronchi, large or small, or both, with no involvement of the peribronchial tissue.

Etiology.—The primary and exciting cause is some micro-organism, as the influenzal bacillus, the strepto- and staphylococci, etc. A dust-laden atmosphere, draughts, sudden exposures with chilling of the entire surface, and wet feet, may act as a direct exciting cause. It may occur secondarily to the acute exanthemata and to diphtheria, and is a frequent occurrence in children who are the subject of adenoids and chronic nasopharyngeal catarrh. Children who are convalescing from acute attacks of diarrhea are prone to develop bronchitis, from lowered resistance. It is a frequent complication of whooping-cough, increasing the severity of this condition greatly.

It occurs in rachitis and other nutritional disorders from a lowered power of resistance.

Pathology.—There is primarily a swelling of the mucous membrane of the larger bronchial tubes, with deep injection, followed quickly by a secretion which is largely serum at first, then mucopurulent as the disease progresses. It is usually bilateral and rarely in patches, even when the smaller tubes are involved. The inflammation is limited to the mucous membrane, and when it spreads to the peribronchial tissue the process becomes a bronchopneumonia. If there is a plugging of some of the smaller or capillary bronchial tubes the portion of the lung supplied by these tubes collapses.

Symptoms.—If there has been a primary tonsillitis or laryngitis, a low fever and slight cough precede the active symptoms of the bronchitis. It may begin as an acute coryza, with sneezing, discharge from the nose, and lacrimation. In mild cases, in which the process is chiefly limited to the larger bronchial tubes, there may be but few symptoms, malaise, slight rise in temperature, loss of appetite and cough. A child under five years of age, uninstructed, will swallow all mucus raised in coughing.

In more severe cases in which the smaller tubes are involved, the child is acutely sick from the beginning. There may be vomiting; the temperature rises to 102° F. or 103° F., and with the development of the cough there is rapid breathing, with wide dilatation of the alæ nasi. The dyspnea is frequently severe, and if any coryza exists it is difficult for the child to nurse. This is especially true where there are nasopharyngeal adenoids.

There is not usually a wide variation in the temperature between morning and evening. There may be an evening drop and a morning exacerbation in rare cases. The temperature usually lasts four or five days, though it may last for a week. It is more easily controlled by hydratic treatment than the fever of bronchopneumonia.

The respirations are hurried, frequently as high as 80 per minute, and there may be a decided pallor of the skin of the

face. When asleep the skin of the head may be bathed in perspiration.

The bowels may be disturbed, especially in young children, and the actions contain much mucus which has been swallowed.

Physical Signs.—*Inspection* of the bared chest shows in severe cases an employment of the extraordinary muscles of respiration, and if there is much spasmodic contraction of the bronchial tubes a recession of the suprasternal and clavicular notches. The respiration is quite hurried.

Palpation of the chest in the first stage may be negative, but during the second stage when there is a secretion of mucus and mucopus, rhonchal fremitus is easily felt, owing to the thinness of the chest wall. For this reason and because of the large tubes, *percussion* is of little assistance as a diagnostic measure in this and some other of the pulmonary diseases of childhood.

In the first stage, before secretion has occurred, *auscultation* reveals sonorous rales if only the larger tubes are affected, and sibilant rales when the smaller tubes are involved. Those rales are general in distribution, but heard loudest at the apex. With the advent of the second stage on the second or third day, with mucus thrown out, moist rales are heard. They are large and small according to the lumen of the tube involved. If coughing occurs when auscultation is being performed, a small area of lung may be found free from rales entirely for a short while.

Through the rales may be heard the normal vesicular breathing, though over the suprascapular and interscapular regions the vesicular sound is replaced by a harsh, high-pitched expiratory sound simulating bronchial breathing. This fact should be borne in mind.

Diagnosis.—The principal diagnosis is from a *bronchopneumonia*, which may not be possible clinically. A localization of the physical signs of bronchitis and a continuation of the above symptoms beyond four or five days is very suggestive. Dulness over a limited area is also suggestive of consolidation or collapse of a more or less large area of lung. In pneumonia there is more dyspnea and the expiratory grunt more likely to be present.

Prognosis.—Older children with acute catarrhal bronchitis

usually recover promptly in four or five days; in infants, until entire subsidence of symptoms the condition should be considered serious, because of the possibility of an extension of the process through the thin bronchial wall and the development of a bronchopneumonia.

In the secondary cases, especially following measles, the prognosis should always be guarded.

Treatment.—The child should be kept in one room, if possible, heated by an open fireplace, with windows open at the



Fig. 48.—Vaporizer.

top and the temperature kept as evenly as possible at between 60° F. and 65° F., never as much as 70° F. The patient should be kept in bed, and several times a day a tent made over it with a sheet and the air impregnated with moist air from a so-called croup kettle or steam spray, which can be medicated with benzoin or eucalyptus.

But little internal medication should be given, beyond a preliminary calomel purge. Frequent doses of syrupy cough mixtures have no place in the treatment of bronchitis.

During the first stage the following tablet is of decided benefit:

R Tartar emetic
 Powd. ipecac aa gr. 1-100
 Sacch lactis q. s.
 M. ft. Tablet No. 1.

These may be given every two hours to a child a year old, unless vomiting occurs. Dover's powders in small doses, gr. $\frac{1}{8}$ or $\frac{1}{4}$, or codeine sulphate, gr. $\frac{1}{8}$ or $\frac{1}{6}$, may be given when the child is put to bed for the night, if the cough is so persistent as to prevent its sleeping. In the presence of a sensation of tickling in the throat, adding to the cough, the application of a cold, wet compress to the neck, protected by a wide, dry flannel, is of great benefit.

No medicinal antipyretics should be given, the temperature controlled by hydrotherapy entirely.

Counter irritation of the chest is of the greatest benefit, mustard plaster giving the best results. One part of Coleman's powdered mustard is mixed with 6 or 8 parts of flour into a thick paste with cold water, spread between two thin layers of cloth, warmed before the fire and applied to the skin. An edge is lifted from time to time to ascertain the depth of the redness of the skin. When the skin is quite red the plaster is removed and the surface greased with vaseline. Enough paste should be mixed to make two plasters, which are applied back and front at the same time. They are very soothing, as a rule, to a restless, dyspneic child, until they begin to burn, and help the cough. They should be reapplied when the skin is pale enough to allow it, probably as often as every six hours. With scanty urine, a teaspoonful of liq. ammon. acetatis in water every three or four hours is of benefit.

Stimulating expectorants can be given older children when the secretion has changed, as

R. Ammon carbonat	3ss
Vin ipecac	5ii
Syr. laurocerasi	3ss
Aquæ dest. q. s. ad	3ii

M. ft. Sol.

Sig. One teaspoonful every three hours.

Prophylaxis is of the greatest importance. Children subject to lymphatism with adenoids and enlarged tonsils, should, in the spring or summer, have these removed. The importance of fresh air should be emphasized; children should not be started to school under seven years of age. They should have a daily

morning bath, followed by a cool sponge and a brisk rub until a vigorous reaction is obtained. The cold spinal douche is a great shock and not well borne by the average child.

The sleeping of the child out of doors should be encouraged, the only consideration being that it be protected from draughts and wind.

The sleeping room at night should preferably not have been used during the day, and if it has, should be thoroughly aired before the child is put to bed. The temperature should not be above 65° F.

The barbarous custom of "hardening" a child by keeping it without shoes or stockings at all seasons is responsible for many of these attacks.

Older children in colder climates should wear under-drawers as soon as bladder control has been established, as there is always a space from stockings top and drawers entirely uncovered.

CHRONIC CATARRHAL BRONCHITIS.

This affection is a direct sequel of an acute bronchitis and occurs in older children who are the subject of nutritional disorders, as rachitis, lymphatism or organic heart lesions, syphilis, etc.

Pathology.—There is a chronic thickening of the mucous membrane, and numerous patches of dilated bronchi constituting either a local or a general emphysema. The mucous membrane is bathed with mucus and mucopurulent secretion.

Symptoms.—Cough is the principal symptom, and this is frequently more distressing at night; expectoration in older children is sometimes profuse; the cough may be paroxysmal; dyspnea is often present; usually there is a very slight rise in temperature, not often more than 100° F. There is pallor and a clammy skin, the child is listless and has very little endurance, showing little tendency to exercise or exhibiting great fatigue with an increase of coughing on exertion.

Physical Signs.—On *inspection* there is noticed a tendency to bulging of the intercostal spaces from the emphysematous condition.

Percussion shows an exaggerated resonance over the whole pulmonary area.

On *auscultation* the respiratory murmur is feeble, and numerous dry and moist rales, large and small, are heard, which may be displaced on coughing.

Diagnosis.—The chief differential diagnosis is from pulmonary tuberculosis. In chronic bronchitis the physical signs are general, the temperature not apt to be as high, the wasting not as rapid, the expectoration more profuse. The tuberculin reaction may be of assistance in making a diagnosis. From pertussis the diagnosis should be easy.

Prognosis.—In children the subject of lymphatism, the prognosis is not very good. If the cough is relieved on the advent of summer the prognosis is better. It is rendered worse by the development of any intercurrent disease.

• **Treatment.**—Nothing is of so much avail in these children as a change in climate, even though it be slight. Removal in the winter to a warm, salubrious climate, free from dampness and winds, in the pine regions, is of the greatest benefit. A place must be chosen where the child can live out of doors. The east coast of Florida, the Gulf coast along Alabama and Mississippi shores, or the pine regions of North and South Carolina and Northern Louisiana. This change should be made in the late fall before an attack.

Forced feeding where this is possible yields excellent results, eggs and milk forming the basis of the extra diet. Sweets of all description should be denied rigorously. Cod liver oil gives the best possible results, administered pure, 15 to 30 drops after eating, if possible.

Iron in an easily assimilable form is of benefit.

R Tinct. ferri chloriri	℥ss
Glycerine	℥ss
Aquæ dest. q. s. ad	℥iii
M. Sig. One teaspoonful diluted after eating.	

EMPHYSEMA.

This condition is a dilatation of the air vesicles and is associated with bronchiectasis, where the larger and smaller bron-

chial tubes are dilated from a long-standing chronic inflammation of the bronchial mucous membrane.

Etiology.—It is a frequent accompaniment of chronic bronchitis, and occurs as a complication of whooping-cough from the violence of the straining during the paroxysms of coughing.

Pathology.—There is a weakening of the walls of the bronchi and air vesicles from chronic congestion and frequent violent stretching from coughing. When limited to the air vesicles it is usually termed vesicular emphysema, and in this event the symptoms are much more severe. The bronchial tubes and vesicles are capable of acute dilatation without serious permanent damage, and in such conditions as whooping-cough the resiliency of the walls of the tube may overcome the dilatation as the disease subsides.

Compensatory Emphysema always is found in the over-worked portion of the lung in pneumonia, and in the unaffected side in pleurisy, with effusion or atelectasis.

The lung is dilated, the diaphragm displaced downward and the chest wall bulging to accommodate them. In the severe form there is a breaking down of the intervesicular walls and a coalescence of the vesicles.

Symptoms.—In cases of chronic bronchitis in which the breathing is specially labored, and there is noticed a change in the contour of the chest, emphysema should be suspected. There is a tendency for the chest to assume the barrel shape, the veins of the skin enlarge, dyspnea is a frequent early sign, and the least exertion causes fits of coughing which are more than usually severe. The heart is dilated and its action often rapid and tumultuous.

Expectoration is usually profuse, especially on awakening, and there may be nausea with a severe paroxysm of coughing.

There is a marked increase in pulmonary resonance and a feeble respiratory murmur, which has lost its vesicular quality. Vocal fremitus is much lessened and the cardiac area of dulness much smaller owing to the overlapping of resonant lung.

Rales are generally present and other signs of bronchitis.

Treatment.—This is largely symptomatic; eliminate the cause when possible. When associated with bronchitis this must be

relieved, the best results being obtained by a change of climate. The cough, of itself increasing the trouble, should be controlled by the administration of a pulmonary sedative: Codeine sulphate, gr. $\frac{1}{8}$ to $\frac{1}{4}$, to child of three or four years, or heroin hydrochlorate, gr. $\frac{1}{32}$ to $\frac{1}{24}$. General tonics are of the utmost importance, fresh air, good, nutritious diet, elimination of sweets entirely.

Close watch must be kept on the bowels, as constipation is present as a rule and aggravates the condition. Regular enemas, cascara aromatic, 10 or 15 drops in water at bedtime.

BRONCHOPNEUMONIA.

Synonyms.—*Bronchial pneumonia; lobular pneumonia; capillary bronchitis; catarrhal pneumonia.*

Etiology.—When secondary to an acute or chronic bronchitis, there is an extension through the mucous membrane of the bronchi and air vesicles, of the inflammatory process. It may be secondary to the acute exanthemata or diphtheria, the toxins and organisms themselves setting up the process. The following predispose to bronchopneumonia: malnutrition, rachitis, adenoids, unhygienic surroundings, living in institutions.

It may occur entirely independent of any known disease as an acute primary condition, due to any of the organisms causing inflammation finding lodgment in the lung. The following organisms have been localized from bronchopneumonia, pneumococcus, staphylococcus, streptococcus, Klebs-Loeffler bacillus, bacillus coli communis.

Pathology.—There is an inflammation of the bronchial mucous membrane, the peribronchial tissue and the air vesicles. The process may involve a single lobe of the lung, a more or less superficial area of the posterior portion or a small spot at any place. Frequently on section a number of small areas of consolidation will be found, with smaller areas of atelectasis, and patches of emphysema nearby. The cut surface is dark and mottled and frothy mucus or mucopus oozes from the severed bronchi. When the consolidated spot is near the surface there is always an involvement of the pleura. This area is roughened and covered

with fibrin. There may be adhesions between the two pleural surfaces.

The bronchial glands are usually considerably enlarged.

Symptoms.—Primary bronchopneumonia begins suddenly, like lobar pneumonia.

In severe cases the attack usually begins with *vomiting*, there is a cough, though this is not always a prominent symptom.

Dyspnea and hurried breathing are prominent and early symptoms. The *temperature* is irregular, not running persistently high as in lobar pneumonia; it may reach 104° F. but is usually below this. Occasionally there is no fever. The *pulse* is accelerated and the respirations hurried; the ratio is usually 2 to 1 or even 3 to 1. The pulse may range between 180 and 200 or higher. The expiratory grunt, which is almost pathognomonic may be present, but not with the same regularity as in lobar pneumonia; there is dilatation of the *alæ nasi*, and there may be more or less *cyanosis*. There is restlessness and prostration.

If the pneumonic condition arises as a secondary disease there is an evidence at once that the child is sicker than it has been for a few days: the respiration and pulse are hurried, the temperature rises, cough becomes persistent and harassing. The cough is dry and, except in older children when secretion is profuse, there is no expectoration.

The dyspnea causes restlessness at night and the cough seriously interferes with sleep also. The skin is generally more moist than in lobar pneumonia, often severe perspiration is seen, though it may be hot and dry. The cheeks do not have the deep red color as in lobar pneumonia, but are more cyanosed.

There may be marked nervous symptoms, but convulsions in the onset are rare. The bowels are not as a rule disturbed, though there may be a diarrhea. The actions are thinner as a rule than normal and may contain mucus. When there is a distension of the gastrointestinal tract from gas the dyspnea is further increased.

Physical Signs.—No two cases of bronchopneumonia present the same physical signs. These may vary from the signs of a *localized bronchitis* to a *frank consolidation*, limited to a small area or involving the most of a lobe.

Inspection reveals hurried, often labored respiration, pallor, dilatation of the alæ nasi, recession of the suprasternal, supraclavicular and intercostal spaces, but without wide range of motion of the chest, owing to the emphysematous condition of the lungs.

On *percussion* there is an increased pulmonary resonance over all except the consolidated area, due to the compensatory emphysema. Even the dulness, found usually over the consolidated area, is much diminished on this account. Owing to the thinness of the chest wall of the infant, percussion is not as valuable a means of physical diagnosis as in older children and adults. Percussion should be performed very lightly.

Palpation may reveal rhonchal fremitus and if the consolidated area is large vocal fremitus may also be felt.

Auscultation is of the greatest help in making a diagnosis. As before stated, the signs of a localized bronchitis are very suspicious. The localized, moist rales may be the only signs heard which are sufficient for a diagnosis, when taken in connection with the other symptoms. They may only be heard on crying or deep inspiration.

Over the anterior chest but little may be heard, unless some consolidation appears here. Owing to the emphysema, the respiratory murmur is enfeebled. Over the posterior aspect, especially, every variety of rale may be heard, with areas over which pleuritic friction sounds are heard. As there are only scattered areas of consolidation, usually the breathing is high-pitched, especially expiration. Voice sounds are increased and the sounds of the cry are exaggerated very much over this area.

Convalescence in some cases may be much prolonged, the general symptoms subside, but the chest condition remains unchanged, resolution taking place very slowly. These always cause much anxiety to the physician because of the possibility of the pulmonary condition becoming tubercular. The child has a progressive loss in weight and appetite, there is pallor, restlessness, and possibly diarrhea, etc.

Complications.—Bronchopneumonia may eventuate in an abscess of the lung, gangrene, pleurisy with effusion, empyema,

any one of which complicate the condition greatly and render the prognosis most unfavorable.

Emphysema and bronchiectasis may result, making recovery difficult. Otitis media, meningitis, pericarditis, endocarditis may occur as a complication.

Diagnosis.—The principal diseases from which a bronchopneumonia must be diagnosed are *bronchitis*, *pulmonary tuberculosis* and *lobar pneumonia*.

From bronchitis the diagnosis is usually made both from the physical signs and the symptoms, though at times it may be difficult to reach a positive conclusion at first. The signs of a *bronchitis* are usually bilateral and general in distribution, while the signs of a bronchopneumonia are localized and usually found at the bases posteriorly. The child does not seem so ill in bronchitis, though at first the temperature may be higher. The course of the disease is shorter in bronchitis. The pulse and respiration ratio is not so widely different from normal.

In *lobar pneumonia* the onset is much more sudden, but frequently the only diagnostic sign will be the uncomplicated bronchial breathing at one place only, as an apex or base, which in lobar pneumonia is so frequently the chief sign. Patches of high-pitched breathing, not distinctly bronchial, with rales here and there is very suggestive of bronchopneumonia. The temperature in lobar pneumonia runs higher persistently and does not fluctuate so much as in bronchopneumonia and ends by crisis. Lobar pneumonia is more frequently a primary disease than secondary.

Pulmonary tuberculosis and bronchopneumonia may at first be difficult of differentiation, and as a tubercular infection may be engrafted on an unresolved bronchopneumonia, it is difficult to tell where one begins and the other ends. There is more often a history of prolonged ill health in tuberculosis than in bronchopneumonia, and the complication of a meningitis more often encountered in tuberculosis during its course. In a prolonged pulmonary tuberculosis there is a persistent and rather regular run of elevated temperature.

Every case of unresolved bronchopneumonia, with a mild rise

of temperature, should be viewed with suspicion, and one of the tuberculin tests made to clear up the diagnosis.

Prognosis.—The prognosis in bronchopneumonia is not nearly so favorable as in lobar pneumonia. Primary bronchopneumonia is less fatal than secondary, such as may occur as a complication of the exanthemata pertussis, diarrhea, diphtheria, etc.

Dunlop¹ reports 333 cases of bronchopneumonia occurring in the Sick Children's Hospital, with a mortality of 28 per cent. The prognosis is influenced by the following conditions: *Age*, worse in the very young; *the extent of the lung involvement*, bad in extensive involvement; *previous health*, when previous health has been poor, and when there have been nutritional disorders, as rickets, or a gastrointestinal disturbance, the prognosis is unfavorable.

The general course of bronchopneumonia is much more prolonged than lobar pneumonia, and ends by lysis in practically all cases.

Treatment.—Hard and fast rules can not be laid down for the treatment of every case. In a general way those measures which will best support and nourish the child, control the temperature and decrease respiratory difficulty will bring about the best results.

The best ventilated and sunniest room in the house should be selected for the sick room, as far removed from the noise of the house as possible. Quiet is very essential. The child should be made to remain in its crib and not held upon the lap, as it can be protected much better from the air from the open windows in the crib, by crib curtains or screen. In winter warm night clothes should be worn. There may be much objection to the fresh air but firmness and reasoning will usually gain its acceptance as a part of the sick room routine. The usual cleansing bath should be given daily.

The *diet* in the artificially fed should be reduced in quantity and quality, in the breast fed the interval between feedings lengthened. Soft diet without meat can be given to older children. Milk should be the basis of the diet.

Temperature.—Pyrexia and hyperpyrexia if greatly adding to

¹ British Medical Journal, August 15, 1908.

the discomfort and distress of the patient, can be best controlled by hydrotherapy. After taking and recording the temperature a tepid sponge bath can be given with the child between blankets, with alcohol and water, at a temperature of about 95° F. to 100° F. If there is no fall in the temperature thirty minutes after the sponge bath, other hydrotherapeutic measures may be used; a full bath reduced from 110° to 95° F.; compresses wrung out of water at temperature of 90° F. applied to the chest; cold pack in the full blooded, sthenic cases; mustard baths at 105° F., for the cyanosed poorly nourished cases. Ice bags to the head are of service in hyperpyrexia and when there is delirium. If there are scattered areas of consolidation, with hyperpyrexia, harassing cough and pleuritic pain, the application of an ice bag to the chest, on a half hour, off an hour is of benefit.

Local Applications.—Poultices, dehydrating agencies, oil silk jackets are abominations and should not be used.

Counter irritation with mustard plasters is of great benefit, made into a thick paste with one part of mustard to six or eight parts of flour, mixed with water. This strength will not blister or burn badly if removed when the skin is a deep pink. Fresh ones can be applied as often as every three or four hours if the skin is normal in color by that time.

The other treatment is largely symptomatic; if the cough is very persistent and annoying at night, codeine sulphate, $\frac{1}{4}$ or $\frac{1}{8}$ grain, is very beneficial; the bowels may need some attention, castor oil at the beginning. Ten grains of bismuth subnitrate every three hours may be given if a diarrhea begins during the course of the disease.

The heart should be carefully watched, and at signs of heart failure stimulants administered for their effect. For a child of one year any of the following may be given: strychnia $\frac{1}{300}$ to $\frac{1}{250}$ grain; tincture of strophanthus one or two minims; brandy twenty to thirty drops, any one of which may be tolerated well by the stomach.

Care should be exercised not to give nauseous doses in this condition, too much depends on the stomach to abuse it.

In unresolved pneumonia it is most imperative that a change of climate be had as soon as possible, to the pine regions or the sea-

side of the South. The child should remain out of doors constantly and sleep out most of the time.

Cod liver oil, iron or hypophosphites are valuable agents during convalescence.

LOBAR PNEUMONIA.

Synonyms.—*Croupous pneumonia, fibrinous pneumonia, lung fever.*

Etiology.—An acute primary infectious disease involving an entire or a portion of a lobe of the lung, due to an invasion of the diplococcus pneumoniae or the pneumococcus of Friedlander. It is much more common in children under two years of age than is generally thought. Riviere shows in 196 cases during the first 15 years that the greatest number occurred at the age of two years. Season is a contributing cause, it being more prevalent in the late winter and spring. Sudden changes in the weather and exposure are predisposing causes.

Pathology.—The process in the lung is practically the same in children as in adults; four stages: *congestion*; the stage of *red hepatization*, in which there is filling up of the air cells and smaller bronchi with products of inflammation and peribronchial and interstitial involvement; *grey hepatization*, with softening and loosening of the exudate; and the stage of *resolution*, in which there is a removal by absorption and expectoration of the extravasated mucus, pus and detritus accumulated in the bronchi and vesicles.

Symptomatology.—The onset is sudden in most cases, the child becomes suddenly sick without any distinct prodromata, as a rule, unless it be *vomiting* and a *rigor*. The rigor may not be noticed in a young child, save by cold extremities, which may be overlooked. With a rise in temperature there may be a distinct *convulsion*, especially in those children who are highly nervous, and who usually give a history of convulsive seizures with each illness, in which there is a rise in temperature. Convulsions are more apt to occur in young children with pneumonia than in older ones.

The temperature rises quickly, being, as a rule, higher than in bronchopneumonia, frequently reaching 103° or 104° F.

There is an excursion of from 1° to 4° F. between the morning and evening records. The *respiration* is accelerated from the beginning, frequently being seen as high as 80 or 90 to the minute, in fact, this symptom may be the first noticed. With it is the characteristic *expiratory grunt*, and a dilatation of the *alæ nasi*.

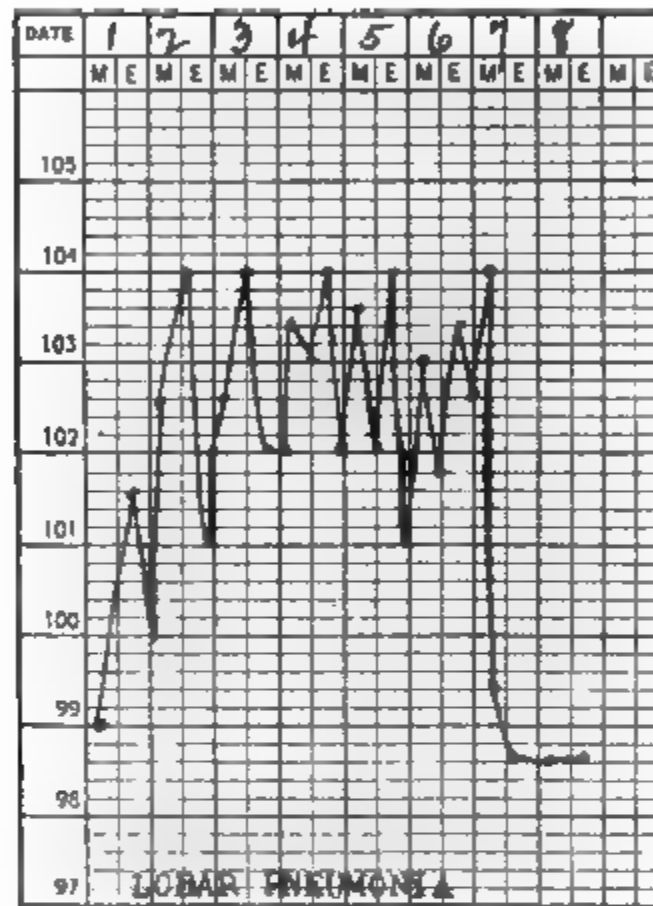


Fig. 49.—Lobar pneumonia, crisis seventh day

The pulse is accelerated and the ratio in this form of pneumonia between pulse and respiration is greatly disturbed; it may be as low as $1\frac{1}{2}$ to 1, though 3 to 1 is more frequent, 150 to 50 being a frequent record. The cheeks are flushed and often the greatest color is noted on the cheek on the same side as the affected lung.

There is usually considerable *prostration*, the child taking but little interest in his surroundings. The *urine* is scant and high colored. *Cough* is by no means a constant symptom, though it is very often present. There is usually no expectoration even in older children, the mucus dislodged being swallowed; when expectorated it is thick, viscid and often blood-stained. If

there is an involvement of the pleura over the affected area the cough is suppressed as it is very painful, and the breathing is chiefly diaphragmatic, and in these cases the expiratory grunt is more pronounced. With a pleurisy there is often a fixation of the neck and upper extremities, as moving them causes more pain. Abdominal pain may be complained of.

Constipation is the rule in lobar pneumonia, and the opposite usually in bronchopneumonia. *Anorexia* is the rule.

One of the best signs as to the amount of compensation which exists is the *color* of the *skin*, *lips* and *lid conjunctivæ*. If they remain red, in spite of the rapid breathing and evident dyspnea, nature is taking care of things. The *skin* is usually hot and dry with no perspiration until after the crisis.

Termination.—The termination of the disease is usually sudden, by crisis, in from four to seven days. The temperature may fall from 103° or 104° F. to normal or subnormal. The temperature may show a slight rise after this drop, which is usually designated as the *postcrisis* rise. Some obscure and central cases of pneumonia may be of very short duration, the crisis occurring as early as the third day.

Physical Signs.—The pathognomonic sign of the *first stage* of pneumonia, the *crepitant rale*, is not heard much more frequently in children than in adults, as the case is usually not seen early enough. The first sign noted may be a diminished or distant respiratory murmur. *Inspection* reveals the rapid breathing, dilatation of the *alæ nasi* and flushed face.

Second Stage.—*Palpation* may give increased vocal fremitus if the area of consolidation is large enough and near enough to the surface. There is dulness on *percussion* over the consolidation and an increased resonance over the uninvolved area. The dulness may shade off into the resonant area gradually.

Auscultation reveals the typical bronchial breathing over the affected area. In auscultation over the apices, posteriorly, the normal broncho-vesicular breathing of this region must be borne in mind. The use of the stethoscope with small bell or chest piece is urged as the area of consolidation which is near the surface may be small. No adventitious sounds may be heard at all, but more frequently moist *rales* are heard on the edges of the

consolidation, during the first stage, and over all during the third stage.

Care must be taken to differentiate the kind of rale heard and its location. Very frequently there is an involvement of the pleura over the affected side, in which event the rales are small, fine and crackling, and very close under the stethoscope, heard most distinctly at the end of inspiration or during coughing. With involvement of the pleura there is pain on coughing.

Over the unaffected portion of the lung there is an exaggeration of the normal vesicular murmur.

In the third and fourth stages the bronchial breathing is fainter and there are many rales present, the rale redux, much like the rale heard in the first stage.

Resolution may rarely be delayed, most frequently it is prompt and complete within a week after the crisis. Auscultation at this time often fails to reveal any difference in breath sounds in the two sides.

The most frequent *site* of the consolidation has been variously stated by different observers. Perhaps the left lower lobe is more often affected, next the right upper lobe, then the right lower lobe. Apical pneumonia is of frequent occurrence, but we believe it is a fallacy to expect meningeal complications more frequently in apical pneumonias than when other portions of the lung are affected.

The *varieties* of pneumonia are usually classified according to the physical signs and the symptoms. *Abortive* pneumonia is that form in which a crisis occurs within a few hours after the initial symptoms, and the lung clears up more slowly; or there may be no positive signs found in the chest. In *typhoid* pneumonia the case is a prolonged one and the general condition is like that of a typhoid fever, but without any symptoms of typhoid, save the low state of the patient. In *relapsing* pneumonia, after a short period of remission of symptoms, there is an exacerbation due to an involvement of new areas. This involvement may be of contiguous lung tissue or an area in the opposite lung involved. *Pleuropneumonia* is a condition where the involvement of the pleura is severe, either with or without extravasation of fluid.

The *complications* of pneumonia are many and often severe. Among these may be mentioned *pleurisy* with effusion. The entire absence of sounds over any area of the lung, especially the base, with an increase in the dullness is always a suspicious occurrence, and effusion into the pleura should be thought of. In these cases the resolution is delayed. Exploratory aspiration should be performed in obscure cases. Empyema, otitis media, pericarditis, endocarditis, peritonitis may occur.

Meningitis is a very grave complication. As before stated meningeal symptoms are not more frequent in apical pneumonia than when the base is affected. The first evidence of meningeal involvement may be an intense headache in those children old enough to localize pain, with restlessness. There is a rise in temperature, pupillary symptoms, perhaps convulsions, etc.

Diagnosis in some cases of deep-seated pneumonia is at first very difficult, as no physical signs are present to aid. It has been suggested¹ that the X-ray illumination of the chest is a valuable diagnostic measure. Three forms may be distinguished, (1) lobar or fibrinous inflammation, (2) disseminated bronchopneumonic foci, yield no shadow; (3) the so-called central pneumonias, which yield a distinct shadow transillumination.

The principal condition to be diagnosed from is a *bronchopneumonia*, which has been mentioned in previous pages.

Appendicitis may be suspected from localization of pain in the abdomen. Careful examination of the chest clears this up.

Prognosis is good. It is graver, the younger the child affected, but in uncomplicated cases the mortality should not exceed 15 per cent under two years of age and 5 per cent in children of all ages.

Treatment.—There is no specific for pneumonia, but much can be accomplished to alleviate suffering and, I believe, to hasten the crisis.

The patient should be placed in bed at once in as large and airy a room as possible and the windows thrown open, no matter what the season of the year. Hot-water bags should be kept to the hands and feet, and the patient even in winter not too heavily

¹ Weill-Shivenet (Arch. de Med. des Enfants, No. 7, 1907).

covered. It should wear an undershirt and night shirt or drawers. Oil-silk jackets, cotton-wadded coats and poultices are not necessary, and, I think, positively harmful.

An initial dose of calomel should be given as soon as the child is seen, preferably in the form of a tablet triturate, finely powdered, to a child of one year a grain; 2 grains to an older child. Castor oil may also be used to advantage.

For temperature above 104° F. there should be given a sponge bath followed by a brisk rub, but for a lower temperature the bath need not be given. With an ice bag to the head for temperature above 103° F., its rise is frequently prevented. The use of ice applied to the affected side, as advocated by Mays of Philadelphia, I have found a very useful measure indeed.

The screw-cap ice-bag, partly filled with crushed ice, wrapped in a towel and applied to the consolidated area, in my experience, has lessened pain, lowered temperature and, I believe, hastened the crisis in a number of cases. The bag is applied and removed in an hour; on an hour, off an hour, being the usual rule.

It may be necessary in cases of severe hyperpyrexia to use the cold pack as described on page 80. Antipyretic drugs are mentioned only to be condemned.

Heart stimulants should not be given as soon as a diagnosis of pneumonia has been made, as is so frequently done. Wait for the indication and give it for that, and withdraw it as soon as possible. Brandy is preferable to whisky, and should be pure.

The *diet* should be liquid, preferably milk, partly skimmed and diluted, or buttermilk to older children. Broths may be given if milk is not tolerated well, an occurrence most infrequent. It will probably be taken in small quantity, at three-hour intervals. Give all the cool water the child will drink.

In the presence of pain from pleuritic involvement a mild sedative, heroin, in $\frac{1}{50}$ grain dose, to child of one year, or codeine sulphate, $\frac{1}{8}$ grain dose, may be needed. A mustard plaster applied to this area is most beneficial.

The condition of the pulse and heart's action should be followed closely throughout the attack. If cyanosis is present there

may be a condition of acute dilatation of the right heart, when a prompt dose of nitroglycerine followed by digitalin, hypodermically, may be the turning point toward recovery.

Strychnia can be given with good effect but should not be given without a clear indication for its use.

The bowels should be closely watched and kept freely open, prompt medication given when indicated, or resort had to enemata.

In the cyanotic cases oxygen is of great benefit and its use should not be postponed too long.

Watchful nursing should be insisted upon after the fourth day when the crisis may be expected, and active stimulation used, if needed, at this time.

After the crisis and resolution has progressed satisfactorily, the child should be allowed to assume the upright position slowly.

At this stage the following prescription may advantageously be used:

R Ammonia chloridi	gr. iv
Syr. ipecacuhana	ʒi
Elix. simplicis	ʒss
Aque dest. q. s. ad	ʒii
M. ft. Sol. Sig. One teaspoonful.	

Syrup of iodide of iron or syrup of hydriodic acid can be used to advantage.

PLEURISY (PLEURITIS).

This is either primary or secondary, and may be of a simple fibrinous variety, or there may be a serous effusion in the pleural cavity.

Etiology.—It has been said by some observer, "Once a pleurisy always a pleurisy," implying that the real cause of a pleurisy is the tubercle bacillus, and that every case of pleurisy should be looked upon with suspicion.

It is surprising how frequently, in postmortem work, adhesions are found between the lung and costal pleura, evidencing an old pleurisy, perhaps recognized at the time but afterward forgotten.

Pneumonia, the pneumococcus, being the active causative factor; traumatism; the exanthemata are frequent causes of pleurisy,

the streptococcus and staphylococcus being frequently present. It is in pleurisy with effusion that the tubercle bacillus is most often found. These may have found entrance to the pleura from the bronchial lymph nodes, the intestinal tract, the tonsils, or the trachea.

Pathology.—In fibrinous pleurisy there is a plastic exudate over the affected area, with cobweb or more dense adhesions if the case is an old one. In the sero-fibrinous form, with effusion, the fluid when aspirated usually flows freely, is albuminous, clear, and of a greenish tinge. If affected with pus-producing organisms the fluid changes in character to pus, constituting an empyema.

Usually but one side is affected, though there may be an effusion in each cavity.

If the cavity is full of fluid the lung is compressed and dense like liver, sinks in water, and is very dark in color. If the collection of fluid is in the left pleura there may be marked displacement of the heart.

Symptoms.—Pleurisy occurs more frequently in children over two years of age. In primary cases, acute in onset, there may be a *chill*, or rigor, *pain* on breathing, especially when lifted or turned in bed or on deep inspirations, soon a hacking, ineffectual *cough* occurs, and there is *fever* running between 101° F. and 102° F. though it may be as high as 104° F. *Respirations* are quick and jerky and chiefly diaphragmatic, unless the diaphragmatic pleura is involved. There is great *restlessness*, and constipation is present, and if associated with tympany the breathing is further embarrassed.

In the form in which there is a gradual outpouring of serum, the symptoms are not so acute, the temperature lower, and as the fluid separates the two inflamed layers of pleura, the pain is less.

The location of the pain is an important aid in diagnosis, and often misleading. It may be referred to the shoulder or to the iliac region, when upon the right side being suggestive of appendicitis.

In this kind of case the child may be up and around, but listless and not inclined to play continuously.

The tongue is furred and the appetite capricious or lost en-

tirely. In evident tubercular cases the clubbing of the fingers is soon noticed.

Physical Signs. Inspection.—Limited movement of the affected side is usually apparent in the first stage of both forms. Fixation of the chest is present in effusion, with displacement of the apex beat of the heart.

Mensuration with two tapes sewed together at 1 inch will show limited expansion of the affected side.

Percussion.—Only with effusion will there be much change in percussion note unless there be a thick fibrinous deposit over the pleura, when there will be an impaired resonance, if not dulness. Over an effusion there is flatness, an entire absence of pulmonary resonance. With a large effusion a line of demarcation cannot be distinctly made out as the pressure on the lung and collapse of the bronchi causes a loss of resonance over the lung. There is exaggerated pulmonary resonance over the unaffected side.

Palpation.—In *pleurisy sicca* friction fremitus can be felt. The displaced apex beat may often be better felt than located by inspection. Over the effusion there is absence of vocal fremitus, with probably an increased fremitus over the compressed lung above.

Auscultation.—If done early in both forms the characteristic pleuritic friction sounds are heard, varying from a distinct crackle, a sound like pulling two pieces of buttered bread apart when held close to the ear, or the sound of creaking leather. As soon as effusion takes place these sounds disappear as do all breath sounds. There is nothing so eloquent as silence over an area of the chest where normal sounds should be heard. A high-pitched breathing, due to compressed lung, may be heard through a comparatively small layer of fluid. Exaggerated high-pitched breathing is heard over the compressed lung, above the level of the fluid and over the unaffected lung, due to the compensatory work done by it.

Vocal resonance is absent over the effusion but increased over the compressed lung.

Diagnosis.—This is usually easy, especially if the effusion is in fairly large quantity. In dry pleurisy there may be some

doubt as to the exact location of rales heard, whether in the finer bronchial tubes or in the pleura, but in connection with the other signs the differentiation can usually be made. A displacement of the apex beat of the heart should make one suspicious of pleurisy with effusion.

Prognosis.—The usual duration of an acute attack of dry pleurisy is from 4 to 10 days, and they rarely terminate fatally, though the side may remain indefinitely crippled from adhesions. If there is enough effusion to cause a marked displacement of the heart, a fatal termination may result. The association of tuberculosis with a pleurisy with effusion should be borne in mind and a guarded prognosis given.

Treatment.—The patient should be put to bed at once and an initial dose of calomel given. If the pain is excessive it can be controlled by an opiate, Dover's powder, paregoric, heroin or morphine. Such relief can be had also from counter irritation by a mustard plaster applied over the site of the pain, care being taken not to raise a blister.

Relief can also be had in some cases by applying an adhesive plaster strip as would be applied over a fractured rib, limiting the motion of that side. The strip should be applied at the end of a deep expiration.

Aspiration in cases of effusion should be done only in those cases in which there is no evidence of absorption at the end of two weeks, or where there is great dyspnea or marked displacement of the heart from left-side effusion. Only a relatively small amount of fluid should be withdrawn, the point of selection being the interspace about the middle of the area of greatest dullness, the patient in the upright position if possible, leaning forward to hold the tissues tense.

The skin should be most carefully prepared by soap and water and alcohol and the needle boiled. The aspirator should be tried with the needle in sterile water to be sure that the current of suction is not reversed. The upper border of the rib should be hugged by the needle to avoid the vessels. No local anesthetic is needed, as a rule, though ethyl chloride may be used.

The iodides are indicated, syr. iodide of iron being most efficient, in half teaspoonful doses to child of two years.

Nourishing food, plenty of fresh air and a change of climate is most beneficial.

EMPYEMA.

A collection of pus within the pleural cavity.

Etiology.—This may be the result of an infection of an extravasated fluid in a pleurisy, or an original or primary infection of the pleura due to the pneumococcus, streptococcus or staphylococcus. It is very rarely an original infection, being secondary to pneumonia in fully 90 per cent of cases. It may also complicate diphtheria and the exanthemata, in fact, any infective process may cause it, tonsillitis, pyema, osteomyelitis, etc. It may be of traumatic origin. In children the tubercle bacillus is more often responsible for pleurisy with effusion than empyema. It more often affects children between six months and three years of age, although no age is exempt. A large percentage of effusions in the pleural cavity in childhood are purulent.

Pathology.—With a large collection of pus as in pleurisy with effusion there is a displacement of the heart. There are numerous adhesions between the two layers of pleura, causing sacculation. The pus is thick, a very dark yellow, and many lumps may be present. This fact must be borne in mind in aspiration, for either diagnostic or curative purposes.

There is an associated unresolved pneumonia, the consolidation being more of the lobar than the broncho type. If there is much fluid there may be a compression of the lung without consolidation.

An infection of other serous cavities may complicate an empyema, a pericarditis, endocarditis, peritonitis or synovitis. Bronchopneumonia may arise as a complication, especially if there is a rupture of the fluid into the lung.

Symptoms.—In primary cases the onset is sudden, a chill or rigor, usually, with pain and dyspnea, much the same as in a pneumonia; a rise of temperature to 103° or 104° F. The fever is usually irregular, a morning remission and high in the evening, followed by a sweat. It must be borne in mind, however, that there may be a large accumulation of pus in the cavity and a comparatively small rise in temperature. In secondary cases

there may have been an apparent improvement in the pneumonia followed by a gradual rise in the temperature, and increase in all the symptoms, the cause of which may not be clear without a careful physical examination. The cough returns and becomes quite annoying, with no expectoration, there is a progressive loss in weight; some pain in the affected side, especially when taking a long breath; loss of sleep; no appetite; restlessness; constipation; anemia and a tendency to clubbing of the fingers. There may be a decided interference with respiration, so the child has to be held or propped partly up in bed. The dyspnea may not be noticed markedly unless the patient is moved, or turns suddenly in bed. This is specially the case if there is enough effusion to cause a displacement of the heart and large vessels.

Physical Signs.—There are no essential differences in the signs found in empyema and in pleurisy with effusion, save when an empyema complicates a pneumonia, owing to the thickness of the fluid and its better conducting power, bronchial breathing may be heard through it. This bronchial breathing is usually more distant and faint than that heard above the level of the pus over the compressed lung. The effusion is usually at the base, but may be localized at several points owing to the possibility of adhesions forming and the fluid becoming pocketed. Collections of pus at the apex may occur, but very rarely.

Diagnosis.—The diagnosis is principally from a lobar or bronchopneumonia, and pleurisy with effusion. The physical signs are to be relied upon principally for a diagnosis. In lobar pneumonia the crepitant rale heard early may be mistaken for a pleuritic friction sound, but this is rapidly followed by bronchial breathing and dulness, whereby the bronchial breathing, if heard at all over the extravasation of fluid, is heard late. There is no displacement of the heart in pneumonia, the percussion note is flat in empyema. A leucocyte count may assist in the diagnosis of an empyema. The polynuclear percentage is high in empyema. From pneumonia, as well as pleurisy with effusion, it may remain for an exploratory puncture to clear up the diagnosis. This must be done under the strictest aseptic precautions, careful sterilization of the needle and preparation of the field and hands.

A needle of sufficient size should be chosen to allow thick pus to flow through. The point of election for an exploratory puncture is in the sixth interspace in the posterior axillary line. It may be necessary to examine a drop of the fluid microscopically to definitely determine its nature, as serous pleural effusion is often very turbid, resembling pus.

Prognosis.—This can be said to depend to a great extent upon the promptness of diagnosis and the method of treatment employed. Age, previous illnesses and cause also influence the outcome as well as the presence and nature of complications. In cases in which there is a mixed infection the prognosis is not so good. Pure pneumococcus infections are more favorable.

Treatment.—The treatment of empyema is surgical, and three methods are in vogue, *aspiration*, *simple incision* and *rib resection*. Aspiration should not be resorted to except as a diagnostic measure. A large quantity of pus may be withdrawn but its tendency is to quickly reform.

As the indication is quick removal of the pus as soon as recognized, the best method of removal is an *incision* of the intercostal space, with tube drainage afterward until the pus ceases to flow. The point to be selected for the incision should be carefully made, the object being to have the opening at as dependent a point as possible, bearing in mind the probable sacculation of the fluid.

Usually the seventh or eighth interspace is chosen about the posterior axillary line, and the incision made 2 or 2½ inches long, close to the upper border of the rib, this being advantageous in avoiding vessels and nerves, and is more convenient in case a rib resection is later necessary.

With strict aseptic precautions the incision is made under a local anesthetic, cocaine or ethylchloride, down to the pleura. A general anesthetic is dangerous. The pleura is nicked and the opening enlarged with an artery forceps, and a considerable quantity of pus allowed to escape. Drainage tubes, previously prepared, fenestrated and armed with large safety pins in the outer end, are pushed in the cavity, and the remainder of the pus allowed to flow out into the dressings, which are immediately applied. Gauze, absorbent cotton, waste or oakum, make

good dressings in the after treatment. The first may be used wet to facilitate absorption.

Should the pus be very thick and not flow freely a subperiosteal rib resection should be done. This requires a general anesthetic. The incision is slightly enlarged, the rib exposed, the periosteum elevated, and a section of the rib 1 or 2 inches in length removed with bone forceps. A tube is then placed in this opening and drainage is much more free.

The *after treatment* of the operative cases consists in daily or more frequent dressing, removal of the tube each day and cutting off from half an inch to an inch and replacing it, until by the end of the week it can be removed entirely.

Irrigation of the pleural cavity should be discouraged always.

Vaseline or oxide of zinc ointment can be used to advantage on the skin around the opening to prevent excoriation. The tube had best be pinned to an adhesive plaster strip and this applied to the skin to prevent its slipping into the cavity.

On the removal of the tube for good a small strip of gauze should be carried into the opening for a few days to prevent its closing too quickly.

Deformity of the chest, due to failure of the compressed lung to properly contract after evacuation of the pus is sometimes seen.

General tonic treatment, fresh air and judicious feeding is of importance in the after treatment.

GANGRENE OF THE LUNG.

This is a rare condition in children, and may only be recognized at the autopsy table.

Etiology.—Some process has been present in the lung previously, favoring bacterial invasion, as a pneumonia or empyema, or as a complication of noma, the exanthemata, suppurative tonsillitis or middle-ear trouble. An embolus of septic origin may be a cause.

Pathology.—There may be one or a number of foci of gangrene; the areas are dark in color and the fluid present is greenish in color and very foul-smelling. There is an area of consolidation usually around these gangrenous spots. If near

the surface a pleurisy generally is found, and they may ulcerate through into the cavity.

Symptoms.—These may be obscure, and unless a bronchus be invaded by rupture of a gangrenous area and some of the fluid expectorated the condition may not be suspected. This fluid is dark, thick, contains pus, blood, mucus and lung tissue, and is foul smelling.

If complicating or following a pneumonia, there is an exacerbation of the symptoms, prostration, usually a foul breath, increase in fever, quite rapid loss of flesh and strength, and sweats.

Physical Signs.—Unless a gangrenous area has broken down, forming a cavity, the signs may not vary from those found in a pneumonia. In this even cracked-pot resonance; amphoric resonance, and probably gurgles may be found.

Treatment.—When a diagnosis has been made and the site of the trouble located positively, a pneumonotomy is indicated following a rib resection. Tonic treatment and stimulation should be begun early.

CHAPTER XII.

DISEASES OF THE DIGESTIVE SYSTEM.

DISEASES OF THE LIPS.

Ulcerations at Angle of Mouth.

Synonym.—*Perleche*.

Definition.—This is a form of cracking of the mucous membrane or ulceration at the angle of the mouth, first described by Lemaistre.

Etiology.—It begins as a small fissure or crack at the corner of the mouth, which becomes infected by frequent rubbing and touching by the tongue, and remains at this point entirely. It is more frequently seen in marasmic and anemic children.

Symptoms.—The erosions are generally linear in shape, confined to both corners of the mouth, are slightly elevated with a red and indurated base. It is painful if the child opens its mouth wide, as when yawning. They may be mistaken for the rhagades of syphilis, but no mucous patches are found in the mouth in perleche.

Treatment.—The course of perleche is usually for two or three weeks. It can be helped by applying a 5 or 10 per cent solution of nitrate of silver direct to the surface, followed by a drying powder, as zinc oxide or bismuth. The application of an ointment to these areas prevents the encrustation over them; bismuth, gr. x, to vaseline, 5i; 3 per cent resorcin ointment; benzoinated oxide of zinc; yellow or red oxide of mercury, are efficient. The use of the ointment following the silver, in winter, is specially desirable.

DISEASES OF THE TONGUE.

Epithelial Desquamation.

This condition is also known as the *geographical tongue*. There is an abrasion or exfoliation of the epithelium in irregular areas

over the surface of the tongue with normal or slightly-coated surface between. The areas are slightly elevated, and when freely desquamated leave a red base. It occurs frequently in bottle-fed infants and causes no discomfort; as a rule requires no treatment other than cleansing washes of boracic acid solution.

DISEASES OF THE MOUTH.

Bednar's Aphthæ.

Pathology.—This is a symmetrical ulceration, one on each side of the median line of the soft palate at its juncture with the hard palate. It is most frequently seen in the new-born or infant under six months of age.

Etiology.—It is caused by the finger of the nurse too vigorously cleansing the mouth, an abrasion of the mucous membrane occurring readily at the attachment of the soft to the hard palate, bacterial invasion taking place at this site. It may follow thrush.

Symptoms.—The child probably refuses to nurse or it may nurse for a few moments, stop and fret on account of the pain. Inspection of the mouth with tongue held down reveals two symmetrical, round ulcers at the point indicated above. They may have a greyish surface, slightly elevated, with reddened area at its base.

Nitrate of silver solution, 5 per cent, applied directly to the surfaces, once daily, and the mouth in front of these ulcers washed after each nursing, usually will cure them in a few days.

STOMATITIS.

This may be of the following varieties: *Catarrhal*, *herpetic* or *aphthous* and *ulcerative*.

The *catarrhal* variety is caused by irritants; trauma; excessively-hot liquids or food, or secondary to exanthemata.

There is an intense reddening of the mucous membrane, and desquamation of the epithelium and a salivation.

Symptoms.—There is a sensation of heat and pain in the mouth; profuse salivation; child will not nurse; is fretful and cries a great deal, may be vomiting; enlargement of glands sub-

maxillary and at angle of jaw; sleeps with mouth open. The duration in robust children is usually only a few days.

Treatment.—But little is required. Antiseptic mouth washes; crushed ice. If no food is taken for some days gavage is of service.

HERPETIC OR APHTHOUS STOMATITIS.

Etiology.—Teething, irritating substances in the mouth, and as a complication of gastrointestinal disorders, pneumonia and other infectious diseases.

Pathology.—Small vesicles appear on the mucous membrane of the lips and cheek; these may coalesce, forming large ones. They are superficial as a rule and associated with more or less general hyperemia, especially of the area of mucous membrane directly about the bases.

Symptoms.—The presence of the characteristic vesicles on the lips, cheek or palate; salivation; difficulty in nursing; enlarged glands. The chief difference is in the appearance of the vesicles.

Treatment.—Care should be taken in using an antiseptic or cleansing wash, not to rub the vesicles so as to leave an abraded surface below. Chlorate of potash, 2 or 3 grains, well diluted, to a child of two years is of great benefit. If the areas coalesce and leave a raw base, nitrate of silver is of service, in a 5 per cent solution. Prophylaxis is most important.

ULCERATIVE STOMATITIS.

Etiology.—It is of bacterial origin, may follow the exanthemata, and complicate carious teeth. It is seen in wasting diseases also.

Pathology.—An ulceration which usually begins at the base of a tooth and spreads over the gum to the mucous membrane of the lips and cheeks. The ulcers usually have a whitish, depressed surface with red edges. There may be deep ulceration at roots of teeth causing them to loosen and fall out.

Symptoms.—Pain when chewing is attempted, excessive flow of saliva, fetid breath, tongue thickly coated, ulcers bleed freely if touched, sordes on teeth, child is fretful, cries a great deal and sleeps poorly. There may be a slight rise of temperature.

The neighboring lymphatic glands are usually enlarged. The gangrenous form may supervene.

Treatment.—Weak peroxide of hydrogen solution 25 per cent followed by an antiseptic wash; saturated boracic acid solution, full strength, Dobell's solution, or solution made from Seiler's tablets. The internal administration of potassium chlorate is almost a specific, and should be given in 2 or 3 grain doses to a child of two years every 3 or 4 hours. The local application of nitrate of silver solution, 10 per cent, to the base of the ulcers is of service.

GANGRENOUS STOMATITIS.

Synonyms.—*Noma; cancarum oris; gangrene of cheek; Wangenbrand.*

This is a sloughing or gangrenous process involving the mucous membrane and tissues of the cheek, as a rule, though it may spread to the gums and lips. Sufficient tissue may be involved to have a perforation of the cheek. Both sides of the mouth may be simultaneously affected. It usually occurs between two and six years of age.

Etiology.—No specific organism has been satisfactorily isolated in these cases, though two Russian observers claim to have isolated a small bacillus and produced the same conditions in guinea-pigs. The diphtheria bacillus, strepto- and staphylococci, have been found. Noma occurs after the exanthemata, and diphtheria, after any wasting or prolonged disease in which resistance is low, and may start from a severe ulcerative stomatitis. It may be epidemic in institutions.

Pathology.—The starting point is usually on the gum near the teeth, and this quickly spreads to the mucous membrane of the cheek. The area involved is more or less symmetrically round, and at first can be felt as a small, hardened mass which soon breaks down, leaving a dark, angry-looking area, bathed in pus, and from which a foul odor emanates. In some favorable cases a mass of tissue separates and falls out, leaving an excavation covered with granulation tissue.

Symptoms.—At first there are few general symptoms, but soon there is fever to 103° or 104° F.; great restlessness; pain; in-

ability to chew or swallow; fetid breath, which is noticeable as soon as the room is entered; the cheek is much swollen and indurated, the edema spreading to the upper and lower eyelids; the skin of the cheek assumes a dusky, dull red color. The neighboring glands quickly enlarge.

In a few hours the slough has extended, and in one to five days unless the process is arrested, the cheek will probably be perforated. At the same time the gangrene may extend to the lower or upper jaw, involving the bone and causing the teeth to loosen and drop out. There is a septic diarrhea, and at this stage great prostration with rapid and feeble pulse.

Prognosis.—The prognosis is grave, fully 75 per cent succumb in spite of treatment. The duration is from one to three weeks, and death ensues from either toxemia or bronchopneumonia. Usually severe deformities of the face remain.

Treatment.—Attention should always be given to stomatitis of any form, especially the ulcerative variety, to prevent the engrafting of a *cancrum oris* upon it. As soon as the diagnosis has been made, under a general anesthesia, the area involved should be thoroughly cleansed and cauterized with the fine tip of a Paquelin cautery, and the cauterization should extend beyond the diseased area. I have had one case recover treated in this manner without perforation of the cheek, but ulceration extending very close to the skin.

In this case an examination of scrapings from the ulcer revealed no organisms except the pus-producing ones.

Loose teeth and spiculæ of bone should be removed.

The diseased area should be touched each day with a 20 per cent nitrate of silver solution, and a cleansing antiseptic mouth-wash used.

It is wise to have a culture made from scrapings from the mass, and the diphtheria bacillus looked for. If isolated, the child should be given a dose of diphtheria antitoxin at once.

Active supportive and stimulating treatment must be used, such concentrated nourishment as beef juice and broth, peptonized milk, egg-nogg, etc.

THRUSH.

Synonyms.—*Sprue, muguet, soor, parasitic stomatitis.*

This is an affection of the mucous membrane due to the growth upon it of a specific organism, the *saccharomyces albicans*.

Etiology.—The *saccharomyces albicans* and not the *oidium albicans* is the cause of the condition. Examination of the deposit shows the white threads or mycelium and the small, oval bodies, the spores. It is usually limited to the mucous membrane of the mouth, but may spread to the larynx, esophagus and stomach. The organism is carried to the mouth, either upon the ordinary nursing paraphernalia or the rubber nipple ("persuader" or "comforter") toys, sugar-teats, etc. Poorly nourished children are prone to develop it.

Symptoms.—Upon the tongue, gums and mucous membrane of the lips, later of the cheeks, there is a white deposit varying in size from a pin point to an area the size of the little finger nail, the larger masses resembling a mass of curds. Patches may be found here and there, or may be very numerous. There is apt to be a coincident gastrointestinal involvement, and the whole area of buccal mucous membrane is hot, red and dry. The child refuses to nurse, or if older its bottle or ordinary food is pushed aside.

This condition is due, as a rule, to neglect or to over-zealous cleansing of the mouth, resulting in an abrasion in which becomes engrafted the infective organism.

Treatment.—The best treatment is *prophylaxis*. It can be prevented by careful attention to details of cleanliness, of both baby and nursing paraphernalia and breasts and nipples of mother. Nursing infants are less apt to develop sprue than older ones. The occurrence of sprue is usually an indication that the nurse or person in charge is careless about the toilet of the mouth before and after nursing, and of the bottles and nipples.

Saturated solution of boracic acid is an efficient remedy and preventive as well. The finger wrapped in absorbent cotton is wet with the boracic acid solution and the deposit gently removed.

This must be done very gently at all times, as the mucous

membrane is very easily abraded. The cotton is best changed as one part is cleansed. If an aphthous or ulcerated spot is found it should be touched with a nitrate of silver solution. A cure is generally had at the end of a week or so.

GONORRHEAL INFECTION OF THE MOUTH.

This is generally associated with an acute infection in the mother of a similar nature, urethral, vulvovaginal, conjunctival, and is due to the specific organism, the gonococcus of Neisser being transferred to the child's mouth. There must first be a trauma, not necessarily macroscopic in size. It occurs usually before the child is two weeks old. Fortunately this is a rare infection, but few cases having been reported.

Symptoms.—These may be very few, and it is entirely possible for the condition to go entirely unrecognized. It may become engrafted upon a Bednar's aphthæ or an abrasion of the mucous membrane due to cleansing the mouth. The swelling and appearance of the mucous membrane is like that seen in catarrhal stomatitis, and to be recognized scrapings from the mucous membrane must be examined microscopically. There is but little discharge. It usually runs a short course.

Treatment.—Cleanliness, frequent washing with boracic acid solution, and twice daily swabbing out the entire buccal mucous membrane, especially under the tongue and lips and gums with a 2 per cent nitrate of silver solution, or the same strength solution of protargol.

Care must be taken to protect the eyes and thumb-sucking must be prevented.

SYPHILITIC STOMATITIS.

When snuffles in a new-born child is seen the mouth should be carefully searched for possible mucous patches.

Any case in which ulcers are found upon the buccal mucous membrane should be looked upon with suspicion.

Typical mucous patches are not as deep as the ulcers of non-specific ulcerative stomatitis, are usually upon the lips or mucous membrane of cheeks, and more rarely on the gums. They have a dull, white base and may be bathed in a thin pus secre-

tion. They may be associated with fissures at the corners of the mouth.

Local application of a mild antiseptic wash, with vigorous antisyphilitic treatment is indicated.

RANULA.

This is a cystic formation under the tongue, on either side of the frenum, and is due to an occlusion of one of the salivary ducts or a duct from one of the mucous glands, a Bland-Nuhn or Rivinian Gland. There may be a lodgement of a small calculus in the duct, closing it.

Symptoms.—When the tongue is raised a small, soft, fluctuating tumor is found under the tongue. The calculus may be felt if present. These may be of such size as to interfere with nursing and with swallowing, even with the closure of the mouth.

Treatment.—Incision of the cysts, the child being held on the nurse's lap, head between physician's knees, who sits facing the nurse. The tongue can be held out of the way by means of the handle of a grooved director.

Saliva or a viscid mucus may escape on incision of the cyst.

TONGUE-TIE.

Every new-born baby's mouth should be examined, and the frenum of the tongue especially inspected. If a baby cannot protrude its tongue between or at least to its lips, the frenum is too short, the tip folding on itself, making it difficult to form a vacuum and the nursing is interfered with. This is seen comparatively infrequently, and when clipped causes great relief.

Treatment.—The child is held as described in the treatment of ranula, and the tongue held by the handle end of a grooved director, the frenum projecting through the slit in this. It is then cut with a pair of blunt-pointed scissors which have been previously set so as to make the cut of prescribed depth, and if this does not liberate the tongue sufficiently it is torn by the finger as needed. The bleeding is usually very slight.

RIGA'S DISEASE.

This condition, described by Dr. Guiseppe,¹ occurs more

¹ Gazz. Degli ospedali-dello clin., No. 153, 1907.

frequently in Southern Italy, and is mentioned because of its likeness to more benign conditions occurring in this country just described. It was first exhaustively studied by Riga in 1880. It does not occur epidemically. The etiology is very obscure.

Symptoms.—It usually occurs in vigorous and previously healthy children during the first six months of life. An ulcer or granuloma forms at the side of the frenum of the tongue, dirty gray in color. The child falls suddenly ill with the appearance of the ulcer, suffers with severe collapse and soon dies.

The treatment is of no avail.

ALVEOLAR ABSCESS.

This is an infection of the gum or the alveolar process, originating usually in a tooth. The conditions may result in an abscess which will discharge within the mouth, but it is not at all uncommon for them to open externally, through the cheek, at the angle of the jaw or below the chin.

Symptoms.—Usually there is a period during which the child complains of toothache, and an examination of the mouth may reveal a cavity which is filled with food particles. After the subsidence of the pain the swelling begins and this is apt to be painless, or nearly so.

The swelling is firm and tense with some redness of the skin. The mucous membrane of the affected side is edematous. Pus usually is found and frequently can be pressed out from the gum along the tooth.

Treatment.—Much more care should be given the teeth of children than is usually the case. Too frequently their cleansing is left entirely to the child and not supervised, food collects and an infected gum results. Children should be taken to a dentist at least twice a year, the teeth carefully inspected, and attention given those which show signs of softening or breaking down.

When an abscess forms it should not be allowed to rupture outside but opened on the inside of the mouth. It should then be treated as any other abscess and free drainage maintained.

Regular inspection of the mouths of school children should be insisted upon by all school boards.

FISTULA OF NECK (BRANCHIAL FISTULA).

A branchial fistula is a congenital failure of the second and third branchial clefts to close. An opening persists in the neck ending at the inner side of the sternocleido mastoid muscle, near the sternoclavicular joint. One or both sides may be affected; if one, it is usually the left.

The tract may end in a blind pouch but usually leads in a more or less straight course to the esophagus or pharynx. If the external opening closes a cyst usually forms rapidly, it being called a *branchial cyst*. The contents of these cysts vary, in different cases. They may contain mucus, serum, serum and blood and epithelium.

Treatment.—The treatment of both conditions is entirely surgical.

ACUTE ESOPHAGITIS.

An acute inflammation of the esophagus which usually is caused by the passage of a foreign body, the swallowing of a caustic as a lye solution or acid, or ammonia. It may follow an acute inflammation of the mouth and pharynx, as in diphtheria or thrush.

Symptoms.—The severity of the symptoms depends entirely upon the strength of the irritating substance swallowed and the severity of the inflammation, if it is an extension from above. In all cases there is great and continuous pain, dysphagia, retching, perhaps vomiting, which greatly increases the pain.

The vomitus may contain pus and usually some blood. There is a greatly increased flow of saliva. Restlessness is a marked symptom.

There is a swelling of the mucous membrane of the mouth and pharynx, and if this is very great there may be considerable dyspnea following the swallowing of the irritant.

The *sequel* in these cases which is most to be feared is a stricture of the esophagus. A spasmodic stricture may appear

as early as the second day, the cicatricial stricture at a later date, after a week or two, or it may be delayed several weeks.

Treatment.—The treatment of the cases after the injury is medical. Morphia or codeine in appropriate dosage to control the muscular spasm and pain; hypodermic stimulation is needed; no food or water by the mouth; sustain the child by nutrient enemata; cold applications externally to neck. As soon as it is certain that an esophageal stricture is present, evidenced by a muscular spasm on swallowing and regurgitation at once, or entire inability to swallow solid food and difficulty in swallowing liquids; under a general anesthetic chloroform or gas and oxygen, the esophagus should be carefully explored by esophageal bougies, olive-tipped, to locate the number and location of the strictures. Makenzie has stated the distance in a child of about two years from the gums to the cardiac orifice to be about 7 inches. The location of the strictures accomplished, their size should be ascertained by passage of progressively larger bougies, and this repeated at intervals of three or four days.

With an impassable stricture the case becomes surgical and may eventuate in a gastrotomy.

STENOSIS OF THE PYLORUS.

Pathology.—Our knowledge of pyloric stenosis is directly the result of postmortem investigations. A pyloric tumor is almost uniformly found about the size of the end of the thumb. It is free from adhesions, oval in shape, firm, hard and smooth. It is located at the pylorus and when present makes easy the location of the pylorus, which is difficult ordinarily.

Microscopically there is found a hyperplasia of the circular muscular fibers, and a very great hypertrophy of the folds of the mucous membrane, which lie longitudinally. Secondary changes occur in the stomach, namely a dilatation and thinning of its walls, which are covered with a thick mucus.

Symptoms.—The child is apparently normal when born. No symptoms are present, as a rule, until the third or fourth day, when the first noticed will probably be vomiting. There is a disinclination to nurse. The vomiting may be delayed as late

as the end of the second week. The vomiting is characteristic, being expulsive, violent and persistent. One or two nursings may be retained, and then the total swallowed is violently ejected. The child is nearly always restless and uncomfortable after nursing and apparently relieved only by vomiting. No nausea is present.

Examination of the vomitus may show free hydrochloric acid, but it is not increased in amount; usually there is no bile present, no blood or lactic acid.

There is obstinate constipation, and what is passed for a number of days continues to be like meconium in appearance.

The child instead of gaining its second week continues to lose in weight. The temperature is below normal and the pulse fast, out of proportion.

Examination of the abdomen may reveal a fairly characteristic condition; a distension of the abdomen above the umbilicus, and a wave of peristalsis may be seen moving from left to right. This is best seen in a good light after a feeding. Below the umbilicus the abdomen is collapsed and concave. Palpation may reveal a pyloric tumor one-half inch to the right and three-fourths of an inch above the umbilicus.

The tongue is clean and the breath normal.

Diagnosis is principally from gastric indigestion and pyloric spasm. In the first the vomiting does not occur as regularly, and the amount vomited is not so large or as expulsive as in stenosis. The bowels, after a few days of gastric indigestion, are apt to be loose and contain mucus, and the loss in weight is not so rapid. No peristaltic wave is seen in indigestion. In pyloric spasm, the symptoms are essentially the same, but there is no tumor present except in hypertrophic stenosis.

Prognosis.—This depends entirely upon the early recognition of the condition and the promptness of surgical intervention. The mortality following operation is high. Of 135 cases collected by Scudder¹ the mortality was 48.8 per cent. He estimates the mortality of medically-treated cases as between 80 and 90 per cent.

Treatment.—This is essentially surgical. An operation should

¹ Scudder: Canadian Practitioner, August, 1908, p. 95.

be performed immediately the diagnosis is made. Scudder mentions three operations: The Loreta operation, consisting in opening the stomach and stretching the pylorus by a pair of forceps introduced through this opening. Second, pyloroplasty and incision from the stomach into the duodenum, across the pyloric tumor, and suturing this incision so as to increase the lumen of the pylorus. Both these methods he discredits as dangerous and unsatisfactory. Posterior gastroenterostomy is recommended after the Mayo method. Several times before the operation it is advised to give an enema of brandy and salt solution. Stomach washing just before the operation. Arms and legs confined to body with separate sheets. Median incision to left of umbilicus. Layer suture of wall after operation will lessen possibility of hernia.

The after treatment is important, the Fowler position; very careful feeding of whey or barley water or breast milk diluted, 10 or 12 hours after the operation, first, a teaspoonful, gradually increased to a tablespoonful every three hours. Breast milk should be substituted as soon as possible.

Vomiting may occur two or three times a day after the operation, but gradually subsides.

DISEASES OF THE STOMACH AND INTESTINES.

General Considerations.—The digestion of infants and children is essentially different from an adult. The new-born infant's stomach is a dilated end of the esophagus, without much shape, but it quickly assumes, however, the shape of the adult stomach. Saliva is secreted in very small quantities until after the eruption of the deciduous teeth. The stomach of the infant fed upon mother's milk should empty itself in two hours, a slightly longer period being taken in the stomach preparation of cow's milk for digestion and absorption. At rest the stomach contains mucus and but little acid, in the presence of milk, hydrochloric acid is secreted. Lactic acid is found occasionally, not always. Free hydrochloric acid is not found immediately after a nursing, but in from one to two hours following.

The principal duty of the stomach in digestion is the precipitation of the casein, the proteid in mother's milk coagulating

in small flocculi, that of cow's milk in larger masses. The rennet ferment or labferment is the coagulating agent. From the stomach the contents pass into the duodenum where digestion proceeds, aided by the pancreatic juices. Here the carbohydrates, peptones and fats are digested and absorbed, the pancreatic ferments being trypsin, steapsin and ptyalin. The bile aids in the emulsifying of the fats. The digestion of fat is a problem which is as yet not fully understood, but it is a fact that fat causes much more trouble than is usually believed.

The *bacteria* of the stomach and intestines are not fully investigated, especially of the former. The principal bacteria which may be found in the stomach are the *bacterium lactis ærogenes*, *bacillus coli communis*, *sarcini ventriculi*, the *hay bacillus*, and other non-pathogenic organisms.

The *Shiga bacillus*, belonging to colon typhoid group, has been found in the intestinal discharges in certain cases of diarrhea, especially in those in which the discharge of mucus and blood is present. Further study may reveal much of the life history of this organism, both in and out of the intestinal tract. Among the others most frequently found are the *bacillus coli communis*, *streptococci*, *staphylococci*, the *bacillus lactis ærogenes* and the *bacillus subtilis*.

The *number of stools* in the 24 hours varies greatly in different babies, the character, consistence and color of the passage being an indication of whether a comparatively large number is within the range of normal. The nursing infant during the first few weeks may have from three to four movements in the 24 hours, after this period they are less frequent, but at least one passage should be had in 24 hours, and under no condition should this be varied from.

The number and character of the bacteria in milk bear a certain relation to this phase of the subject. It is well known that ordinary market milk contains from 300,000 to several million bacteria to the cubic centimeter, and it has been repeatedly shown that such milk fed to infants results directly in serious digestive disturbances and frequently in severe toxic and inflammatory conditions of the stomach and intestines.

The Feces.—The feces of the new-born are thick, black, tarry-like and tenacious, called *meconium*. These characteristic movements give way to the normal stool of the infant. These are yellow, smooth, consistent and mush-like, as soon as the mother's milk is secreted or when milk is fed artificially, the black color being gradually replaced by the yellow toward the third or fourth day. The mother's milk varies so in its analysis at different times of the day and night that the infant's stools may vary greatly in 24 hours. They may vary from a bright yellow to a decided greenish color, and may contain minute or larger-sized masses, whitish in color.

These masses may be composed entirely of casein, in which case they are firm and hard, or of fat, when they are soft and smooth. If they are fat masses they may have a casein center or bacteria may form the nucleus. The recognition of the character of the "curd" in a movement is of importance in artificially-fed infants. The stools of artificially-fed infants, as a rule, are larger in amount and lighter in color. The effect of carbohydrate diluent in milk is shown in the stools by the curds being softer and smaller than when water is used as the diluent.

Thin, yellow, acid movement, containing fine white, curd like masses which are soft and easily spread when pressed upon—too much fat.

Large, bean-like, firm masses, with discolored, shiny capsule—casein in excess.

Mucus, thick and tenacious, in large quantities—inflammation of sigmoid or colon. When green discoloration is present with acid reaction of stool there is serious disagreement of the food.

Foamy, acid stool—too much sugar.

The reaction of the infant's stools fed on breast milk is usually acid, when fed on cow's milk is either neutral or alkaline.

The odor of the normal breast-fed infant's stool is acid, while that of the artificially fed has the odor of decomposition. This is especially so when animal broths are ingested.

The bacterial flora of the infant's intestine has been the subject of interesting study by a number of observers, but is of no clinical value as yet.

GASTRIC DISORDERS.

Disorders of the stomach may be *functional* or *organic* or *reflex*. One of the principal symptoms of disorders of the stomach is *vomiting*. The natural position, shape and size of the infant's stomach makes vomiting very easy. It may be only a regurgitation of the food as it has been ingested, or the entire contents may be expelled, occurring at different periods after feeding. Among the causes are too-rapid feeding, impure milk in the artificially fed, changes in the mother's milk from various causes, pyloric or intestinal obstruction, ulceration of the stomach, cyclic, recurrent or periodic vomiting, and that caused by the acute infectious and exanthematous diseases.

ACUTE GASTRIC INDIGESTION.

Synonyms.—*Acute gastric catarrh. Acute dyspepsia.*

Acute gastritis, that caused by the swallowing of caustic or corroding substances, is rarely seen in infants, and its symptomatology is practically that of acute indigestion.

Etiology.—The most frequent causes of an acute indigestion are irregular and over feeding. Changes in the character of the milk may cause it; as a single cow's-milk feeding substituted for a breast feeding; changes in character of the breast milk from nervous excitement, fear, anger, etc.; over indulgence in older children at children's parties; pastries; hurried eating and improper mastication, as is the case when carious teeth are present; sudden changes in temperature; violent exercise after eating; too early bathing after a meal, etc.

Predisposing causes are a prolongation of any one of the active causes mentioned, as irregular feeding and eating between meals, frequent indulgence in sweets and any condition which lowers vitality.

Pathology.—No specific lesions are present, the condition being functional, an arrest of secretion most likely, as well as muscular action.

Symptoms.—The first symptom may be languor and lassitude; the child, if older, will lie down in preference to playing, and if old enough may complain of headache. Pain referred high up in the abdomen may be present, followed by nausea, vomiting

and retching. The vomited matter shows food as it was swallowed, perhaps some hours before, and is apt to be sour.

There is always a rise in temperature, it may be slight, but is usually between 102° and 104° F.; the pulse is rapid, with slight increase in the number of respirations. There is much prostration, languor and deep sleep after the cessation of the vomiting. I have seen repeated convulsions until the stomach was completely emptied. I recall one child which had a number of severe general convulsions at intervals for several hours, which ceased only after the stomach was entirely cleared out. The movements are apt to be abnormal, containing undigested food and showing signs of fermentation, are frequent, and accompanied with gas and straining. The nausea may continue some hours after the cessation of the active vomiting.

Prognosis.—This is usually good as soon as the stomach and intestines are thoroughly cleared out of all undigested and irritating substances. In neglected cases, or those fed too soon after an attack, there develops a severe condition of the bowel which may result fatally. The younger the child the more severe the toxemia.

Diagnosis.—This is not always easy. It may be difficult to rule out the beginning of one of the exanthemata, which may be determined only by the appearance of the rash, or a pneumonia, by the development of the pathognomonic physical signs.

Treatment.—The first indication is to empty the stomach. In an older child this may be facilitated by causing it to swallow a glass or so of water, cool or warm, this being ejected at once brings with it much offending material. If this is not possible the stomach should be washed. This is accomplished by a soft rubber catheter, No. 16, American, which is attached to rubber tube by a glass tube, with a funnel at the free end. The catheter is passed into the stomach, the child being held in the upright position or lying upon its left side upon an attendant's lap. In order to control its hands it should first be enveloped in a sheet. With the catheter in the stomach, warm water not over 100° F. is poured in the funnel, it is then lowered and the stomach contents siphoned out, this process being repeated a number of times until the wash water returns clear.

Plain, boiled water is best though a solution of bicarbonate of soda can be used if the vomitus is very acid smelling.

After the water has been returned clear for two or three siphonages, from 2 to 3 ounces of water are poured in the stomach, the tube tightly pinched between the fingers and quickly withdrawn. Pinching of the tube prevents any drops from escaping into the larynx as the tip of the tube slips over it. This water is nearly always retained and allays thirst.

The stomach should have absolute rest for three or four hours after lavage, and for the first 12 hours, at least, nothing but water given by the mouth. After the lavage calomel should be given, $\frac{1}{2}$ grain at one dose for a child of six months, 1 grain to a child of one year. One grain of calomel for each year of age up to five years, 5 grains, can be given with the greatest benefit in these cases.

Even in breast-fed infants nursing should be resumed most carefully. The breast should be emptied regularly and the milk thrown away until nursing can be begun. In the artificially fed, milk should be returned to more slowly.

When all nausea has ceased and the movements are improved give dextrinized barley water, then whey and barley water or one of the animal broths, plain or with barley water; albumen water, if there is not a great deal of gas. Care should be exercised in the amount of food which is given at a feeding, at first 1 or 2 teaspoonfuls, then $\frac{1}{2}$ an ounce, and, finally, the usual quantity taken by the child.

But little medication is called for in these cases other than the calomel. Good results are often had from *cerii oxalatis*, 2 grains every two or three hours, where the nausea persists after the cessation of the vomiting.

Should constipation follow the active symptoms, the bowels are best controlled by the use of enemata or glycerine suppositories, rather than by the administration of laxatives or purgatives, which may cause nausea or vomiting again.

Hydrotherapy should be used to control the temperature.

Rest in bed is most essential and the child should not be held or coddled.

ACUTE GASTRITIS.

Etiology.—Any of the causes of acute gastric indigestion, if prolonged, may cause this condition, or if the child is in a particularly run-down condition an acute catarrh may result in an acute gastritis. It may complicate the exanthemata, influenza, diphtheria or pneumonia, and is frequently secondary to acute inflammatory conditions of the intestinal tract. The ingestion of any of the caustic irritants will cause it.

Pathology.—The stomach may be found contracted or dilated, usually the former, the mucous membrane is congested, thickened, softened and covered with a thick mucus, with more or less food free in its cavity. Macroscopically but little can be detected, a small hemorrhagic area may be seen. Microscopically the inflammation is seen to be mostly tubular, the epithelium is shed.

If the inflammation is due to the swallowing of caustic poisons there are areas of ulceration, the congestion is much more intense and the mucous membrane more swollen.

Symptoms.—The onset is similar to that of gastric indigestion, pain, vomiting and fever. The vomitus at first is food, then mucus, which may be blood-tinged, there is diarrhea during the acute stage, followed later by constipation. The temperature is not as high as in indigestion and gradually disappears as the disease progresses toward a favorable termination. The duration of the attack is from five to seven days.

Prognosis.—In the robust the prognosis is good, in the weak and athreptic it is not so favorable. The danger in the form due to the ingestion of caustic substances is in a stricture of the cardiac orifice of the stomach. It may result in a chronic gastritis or severe inflammatory conditions of the intestines.

Treatment.—The early treatment is practically that of an acute indigestion, rest in bed, evacuation of the stomach, even if resort must be had to the stomach tube. The stomach washing can be repeated daily or oftener, if necessary, and starvation.

The physician must have entire control of the diet of the patient. Proper food must be given, and this means properly selected, prepared and administered, and at the proper intervals.

Dextrinized barley water should be first given, and if tolerated, in a few feedings some milk, in very small quantities, can be added to it, preferably centrifugal skim milk which contains much less than 1 per cent of fat. Buttermilk will frequently be tolerated when whole or skimmed cow's milk will not.

Hydrotherapy should be used exclusively for high temperature. If there is much thirst and the vomiting continues, a high saline enema will prove of service.

Bismuth in large doses, 60 grains in the 24 hours, is a valuable agent in this condition.

R Bismuth subnitrat	℥iiss
Syr. rhei aromat	℥i
Aque dest. q.s. ad	℥ii

M. (Shake.) Sig: One teaspoonful.

A daily or twice daily bath should be given; when there is a rise in temperature, it can be used oftener.

CHRONIC GASTRITIS.

A chronic inflammatory condition of the stomach, occurring independently or with a similar condition in the bowels. There may be but slight change in the mucous membrane, the symptoms being from the functional disturbances present.

Etiology.—A single attack of acute gastritis, or prolonged attacks may result in the chronic form. It is much more apt to occur in hospital infants and those who are run down from any cause, and in those who live in squalor and unhygienic surroundings. Any of the diseases of nutrition, as rachitis, tuberculosis, anemia, are direct predisposing causes. Improper food, bananas, tea and coffee, pastries and sweets, may act as a cause.

Pathology.—The mucous membrane is thickened and shed largely of its epithelium; there is much more mucous on the surface of the membrane than in the acute form, and frequent lavage is often needed before the stomach is entirely rid of it. It is so tenacious that a large quantity of water may be needed to entirely remove it. The stomach wall is thickened and the stomach itself distended. The solitary follicles are enlarged.

Symptoms.—Frequent vomiting without apparent cause is

the most regular symptom, and often undigested food is vomited several hours after it is eaten.

This is due to the interference with the motor function of the stomach walls from the inflammation and the distension, and to the perverted stomach juices.

There are frequent attacks of colic; coated tongue, rapid loss in weight; sour breath, the muscles are flabby; the skin assumes a yellowish color; the bowels are constipated at first, followed by diarrhea; there is a loss of appetite; loss of sleep and restlessness; circulation is poor, and extremities cold. The child may live for a long while, wasting rapidly and die suddenly at the end, when death has hardly been expected.

Prognosis.—In general this is not good, unless the physician has constant and direct control of the diet, hygiene and life of the child. Intestinal involvement influences the prognosis badly. Recovery is slow.

Diagnosis.—The principal condition to be borne in mind is that of pyloric stenosis, considered in another place (see page 243). Chronic gastritis is not apt to occur in the newly-born, in whom pyloric stenosis is most often seen.

Treatment.—As already stated the physician must be in control of the child as to its habits, hygiene, mode of life and diet. A change of climate is often of the greatest benefit. Stomach lavage daily, then every other day until vomiting is relieved, should be practiced. These patients should live out of doors at all seasons, well protected by flannel band and underwear, and outside wraps in winter. The feet should be frequently inspected and hot-water bottle used if needed. Woolen stockings should be worn. Daily tub baths, followed by a cocoanut-oil rub, should be given. The hygienic care should include the frequent change of napkins as soon as soiled or wet, and their proper cleansing.

The diet is most important. If breast fed an analysis, as complete as possible, must be made of the mother's milk. If over rich in fat, an attempt made to regulate this ingredient. If, in spite of every effort to change the character of the milk, the vomiting continues a wet nurse, whose baby's age approximates the patient's may be procured. If this is unsuccessful,

resort should be had at once to a modified milk, at first practically eliminating the fat content. This can best be done by utilizing a centrifugal milk in which the fat has been reduced below 1 per cent, or a fat-free buttermilk made with the lactone tablet can be used. If this is retained the prescription can be increased slowly by addition of .25 per cent of fat daily, or every other day, until 2 per cent has been reached, unless vomiting recurs when the fat-free mixture is again used.

Fat-free whey diluted with equal parts of barley water is frequently well borne. The first essential in regard to the milk is that it should be either certified or inspected.

If milk is not tolerated in any form, after lavage, give dextrinized barley water in small quantity, by gavage at first, then in 2 or 3 teaspoonful quantities, gradually increasing the amount.

The animal broths are frequently well borne, or beef juice, expressed immediately before feeding and diluted with quite warm water to prevent its coagulating.

It may be necessary to continue the use of gavage for several days.

One great mistake is made in these cases in trying so many foods in a short space of time. Kind neighbors and friends harass the mother frantic by suggestions as to this or that food, and the physician is asked in regard to each new one in turn.

It is a mistake to believe these athreptic infants need alcohol. It is the worst remedy which can be used, and is responsible for much trouble. In giving the proprietary preparations panopeptone and peptonoids, their alcoholic ingredient must be remembered.

If the vomitus is very sour good results are sometimes obtained from the use of bicarbonate of soda in the wash water in the proportion of a teaspoonful to the pint of water.

But little medication is needed or can be given in these cases. Save the stomach for food which is most needed. Fowler's solution of arsenic is of service, in drop doses in water three times a day, and strychnia sulphate, gr. 1/200, to a child of one year, assists in toning up the stomach muscle.

If constipation is present it can best be controlled by use of

enemata and glycerine suppositories, alternated, each morning at the same time, the child being placed on its chair immediately after its use.

GASTRIC DILATATION (GASTRECTASIA).

This condition should be differentiated from an enlarged abdomen, so-called *pot belly*, which is so frequent in yearlings or during the second year, this most often being due to a dilatation of the colon.

Etiology.—The most frequent cause in new-born babies is pyloric obstruction or stenosis. The next is a stretching of the muscular wall due to fermentation and decomposition of the food contents, as occurs in chronic gastritis. It is a manifestation of general nutritional disorders as in rachitis and tuberculosis. Frequent attacks of acute indigestion; too frequent eating and improper foods are also causes.

Pathology.—The changes in the stomach vary in these cases, as found postmortem; often great evidences of chronic gastritis are present. The degree of dilatation also varies, as postmortem change may show considerable contraction in a stomach which had been shown to be enlarged before death.

Symptoms.—These are as outlined in the previous section in chronic vomiting; sluggish circulation; waxy color; cold extremities; thirst; poor appetite; coated tongue; high-colored urine; constipation. Percussion shows an increased area of stomach resonance, perhaps below the umbilicus, and this is confirmed by introduction of water slowly through the stomach tube to point of tolerance. Air injected into the stomach should never be employed as a diagnostic procedure in a child because of the danger of rupture of the stomach.

Prognosis depends upon the cause, and if not organic upon the early diagnosis and early removal of the cause.

Treatment is practically that of chronic gastric catarrh. Relieve the stomach of its fermenting contents, with sufficient wash water to have it return entirely clear. Wash daily at first then twice and finally once a week, continuing several weeks at least. Small quantity of food, predigested at first, at two or three hourly intervals, liquids entirely at first.

Nux vomica, 1 or 2 drops of the tincture to a child of two years three times a day, well diluted, is beneficial. Careful attention to the bowels, the wearing of an abdominal binder; daily baths, general rubbing, and moderate exercise in the fresh air will be found very beneficial.

CYCLIC VOMITING.

Known also as recurrent or periodic vomiting. It is a condition characterized by severe vomiting and prostration with but little fever as a rule, in which no active cause, as indiscretions of diet, can be traced.

Etiology.—This is obscure and has been the subject of much conjecture. It is doubtless due to an increased acidity of the fluids of the body from some disturbance of elimination and absorption. There is an acetone odor to the breath, and symptoms of a toxemia are present. Acetone bodies, diacetic acid and oxybutyric acid are found in the urine. There seems to be a fairly uniform decrease in uric acid elimination. The basis of the trouble seems to be a disturbance of metabolism rather than an error of digestion. My own cases have failed to reveal any uniform digestive disturbance preceding the attacks, or any special article of diet as responsible for them. The starchy foods have been thought by some to be a cause.

Symptoms.—Cyclic vomiting rarely occurs in infancy, but is more frequently seen in children between 5 and 10 years of age. My cases have been about evenly divided in the sexes, though girls are said by some observers to be most often affected.

The onset is usually sudden, and without any dietary indiscretions. The vomiting may begin in the night, or the child awakens in the morning, heavy and dull, and complains of nausea, perhaps of pain in the abdomen, which is soon followed by vomiting. If vomiting occurs at night the supper may be vomited undigested, if later in the morning, the first vomitus may be only fluid. The child continues to vomit at frequent intervals, with retching between, the vomitus being principally mucus, perhaps bile-stained and a few streaks of blood. Any attempt to administer medicine, food or water results in its rejection at once.

As a result of the continuous vomiting and retching, prostration develops early, the pulse is accelerated, the child drops back after each attack prostrated, the face is pallid, the eyes sunken, lips and tongue parched, the latter coated; abdomen retracted, urine highly colored and scant, and the characteristic sweetish or acetone odor to both the urine and the breath.

As a rule there is no temperature, though in one of my cases the temperature rose to 102° F. in a number of attacks. Constipation is the rule, though usually a movement can be obtained by an enema.

The *duration* of the attack is always 30 to 48 hours, and it may last for three or four days. The frequency of the vomiting is gradually lessened as the disease progresses, and I have seen a child in an hour's time after severe vomiting call for water and retain it and everything given subsequently. There is no regularity as regards the time of the *recurrence* of the attacks. One of my cases, under observation for two years or more, had a recurrence on an average of once every four months, though not regularly at that interval. In this case the attacks were undoubtedly rendered less severe and more infrequent by the alkaline treatment.

Diagnosis.—The diagnosis must be made between meningitis, appendicitis and organic lesions of the kidney. The failure of brain symptoms to appear eliminates meningitis from consideration, though it should always be thought of. Urinary analysis is of importance in ruling out kidney lesions, and this is a diagnostic aid which is too frequently overlooked.

The presence of acetone in the urine is confirmatory evidence of cyclic vomiting. Among the tests for acetone are the following:¹

1. *Lieben's Iodoform Test*, as modified by Ralfe, is as follows: 20 grains of potassium iodide are dissolved in a drachm of liquor potassæ and boiled; the urine is then floated upon the surface of the fluid in a test tube. At the point of contact a precipitation of phosphates occurs, which, if acetone be present, becomes yellow and studded with yellow points of iodoform.

A more delicate method of application of this test is to first distill a small quantity of the urine and apply the test to the

¹ Purdy: "Practical Ureanalysis."

distillate. This test has one disadvantage; lactic acid and ethyl alcohol behave with it similarly to acetone.

2. *Chautard's Test.* A drop of aqueous solution of magenta decolorized by sulphurous acid gives, with fluids containing over 0.01 per cent of acetone, a violet color. This appears in dilute solutions after four or five minutes.

3. *Le Noble's Test.* On adding an alkaline solution of sodium nitroprusside—so dilute as to have only a slight red tint—to a fluid containing acetone a ruby-red color is produced, which in a few minutes changes to yellow, and on boiling, after adding acid to a greenish-blue or violet. A quarter of a milligramme of acetone can be thus detected.

4. *Baeyer's Indigo Test.* A few crystals of nitrobenzaldehyde are dissolved by heat in the suspected urine; on cooling the aldehyde separates in the form of a white cloud. The mixture is then made alkaline with dilute sodium solution, and, if acetone be present, first yellow, then green, and lastly an indigo-blue color will appear within 10 minutes.

5. *Reynold's Test.* This test depends upon the fact that acetone promotes the solution of mercuric oxide. The test may be conducted as follows: The yellow precipitate of mercuric oxide, obtained by the reaction of mercuric chloride with an alcoholic solution of potassium hydrate is added to a small quantity of the urine, which is shaken and filtered. To the clear filtrate ammonium sulphate is carefully added, and if acetone be present some of the mercuric oxide is dissolved and a black ring of sulphide of mercury appears at the plane of contact between the two liquids.

Prognosis.—A few cases have been reported with fatal termination, but these are very unusual. They recover in from two to four days.

Treatment.—Active treatment during the attack is of no service. Nothing should be given by the mouth except perhaps a preliminary draught of water for the purpose of washing the stomach as it is immediately vomited. The best results are obtained from high rectal injections, first for the purpose of evacuation and followed by an injection of a solution of bicarbonate of soda, 2 drachms to the pint, with the purpose of having it re-

tained. These enemata should be alternated at four-hour intervals with predigested milk in quantities not to exceed 4 ounces given through a catheter into the sigmoid if possible.

If the retching is very severe and the prostration extreme, the use of codeine, sulphate, grain $\frac{1}{8}$, to a child of five years, or morphia sulphate, grain $\frac{1}{32}$, will give good results.

As soon as the vomiting ceases and the child asks for water it can be given tentatively. Crushed ice at first, small quantity of water, and repeated in larger amounts at short intervals, then a broth followed by diluted skimmed milk. As soon as possible a cathartic should be given, cascara or a part of a bottle of citrate of magnesia.

In the interval between the attacks, the regular administration of bicarbonate of soda in 3 grain doses, four times a day, over a period of three or four weeks, with a week's rest, and a resumption of it at the end of that time for another three weeks, and so on for four months, will lengthen the interval between attacks. Milk of magnesia can also be used with benefit.

The diet should be a mixed one, a very moderate amount of meat, and sparingly of cereals, no raw fruits, otherwise the diet is not restricted.

If an attack seems imminent the dose of soda should be increased to double, 6 grains every three hours.

Some children cannot be persuaded to take the soda by the mouth. This was the case with one of my patients who readily submitted to its administration twice daily in an enema.

If there is a history of rheumatism the salicylates should be given but not as a routine.

COLIC.

Special consideration of this *symptom* is made necessary because of the frequency with which it is encountered in infancy. It must be borne in mind, however, that the average mother or nurse attributes every crying spell an infant has to the colic, and a popular belief among the laity is that every child is likely to have colic until it is three months old.

When a history is given of crying, with a tense abdomen and audible rumbling of gas in the intestine and the frequent cructa-

tion of gas from the stomach, the condition is probably one of colic, but the frequency with which serious intraabdominal conditions may develop with colicky pains in the abdomen as the chief symptom, makes it necessary for careful consideration to be given each case in which abdominal pain is a feature.

The colic which occurs in both breast and artificially fed infants is due to a fermentation in the stomach and intestines of the food ingested and the rapid accumulation of gas, the pain being caused by its passing rapidly from the stomach or through a knuckle of gut. It may also be due to a spasmodic condition of the intestine, produced by an undigested mass of food acting as an irritant as it passes through the bowel. In the artificially fed a too large carbohydrate content or the use of undextrinized cereal diluent may be the cause of the rapid fermentation.

A breast-fed child may nurse too quickly from a very full breast and swallow some air with the milk. It may stop in the midst of a nursing, throw off the gas, and resume the nursing. If held for a moment on the shoulder, with its abdomen being pressed upon, this eructation is facilitated.

If the rubber nipple through which an artificial feeding is taken allows the milk to flow too freely, this same condition may obtain, or if the milk is taken too cold the tendency to gas formation is increased. Too frequent feeding is also a cause, the effect being an indigestion with fermentation.

Symptoms.—The chief symptom of colic is pain in the abdomen, which causes the child to cry out, the abdomen is tense, and with the hand on the abdomen the gas can be felt as it moves in the intestines. The weight of the hand may sometimes give relief. The symptoms develop shortly after a feeding or, as already stated, may come while nursing, either from the breast or bottle, due to swallowing air with the milk.

The child is restless and fretful, its feet and hands are cold, and it cannot be pacified in any position. It may fall asleep in the midst of its crying and waken with a start to resume.

It is not uncommon, especially in the artificially fed, when the carbohydrate content of the milk is responsible for the gas formation, for the symptoms to develop several hours after a feeding, and the child may remain awake most of the night.

Relief comes almost immediately after the gas is passed and the child falls into a restful sleep.

Diagnosis.—This must be made from *appendicitis*, *intussusception* and *acute middle-ear inflammation*.

In *appendicitis* there is an area of tenderness and localized rigidity. In colic the weight of the hand often affords relief, and the whole abdomen is rigid.

In *intussusception* a tumor is apt to develop early, which is associated with acute constipation and bloody discharges. Bloody, mucous movements may be present in the colic which is present in acute gastroenteritis, but in the ordinary form of colic here described these stools are not seen.

In the acute *middle-ear inflammations* the child puts its hand to the affected side or picks at the ear, and the character of the cry is different, it being more shrill and piercing than the cry from colicky pains.

Treatment.—*Prevention.* Care must be exercised as to the feeding of the child, regularity, quantity, frequency, and in the artificially fed the food prescriptions should be carefully considered. If the child is newly put upon artificial food the first food prescription must be weaker than is necessary for the child's needs, and gradually increased until it gains in weight, in order that its digestion be not upset in the beginning.

If on the breast, the breast milk should be clinically examined by the Holt milk set, and any ingredient found at fault corrected, as indicated in a previous chapter.

During the attack, those remedies are indicated which will assist in the dislodgement of the gas. If the gas seems high up the administration of peppermint water, half teaspoonful in water, will assist the child in belching.

The elixir of catnip and fennel in 10 or 15 drop doses is a serviceable remedy. Hot applications to the abdomen, the weight of the hand on the abdomen, letting the child lie upon a hot-water bag on a pillow, face down, holding it over the shoulder, causing pressure on the abdomen, are means which are of service in obtaining comfort.

A warm enema, given through a catheter introduced more than half its length, containing a few drops of turpentine, will

dislodge gas low down in the intestine and often produce complete relief.

Soothing syrups should never be given as they all contain opium. Opium should not be given under any conditions as a routine, in fact, only as a last resort. If it is decided that opium is imperatively needed, paregoric is the best form, in 10 or 15 drop doses, well diluted. The bromides are safe, and can be used if the child is very restless and cannot be quieted or get to sleep:

GASTRALGIA.

A sudden and severe pain in the abdomen, principally in the epigastrium, which cannot be traced to an indiscretion in the diet or any definite lesion of the viscera.

It is considered to be a neurosis, a neuralgia affecting the nerves of the stomach.

We know nothing which is definite of the etiology or pathology of this condition. It is more than likely associated with the rheumatic diathesis, whatever that may be.

Diagnosis and Symptoms.—The symptoms of gastralgia are best considered under the head of differential diagnosis.

Children, as a rule, do not locate pain accurately, hence when a pain is referred to the epigastrium other conditions may be present which may have pain as a principal symptom, but referred to near or remote organs. Among these may be mentioned a diaphragmatic pleurisy, pneumonia with small pleural involvement, vertebral caries of the middorsal region, intercostal neuralgia, inflammation of the pericardium, endocardium, or the appendix.

An investigation of the regions giving rise to these conditions will usually rule out the more serious conditions. The pain in a gastralgia is usually more or less spasmodic, entire relief, except perhaps a slight feeling of soreness being experienced in the interim between attacks. Rarely there may be nausea, and more rarely vomiting caused by the pain entirely, and with no signs or symptoms of indigestion.

Appendicitis should be carefully excluded in making a diagnosis of this condition.

Treatment.—Rest in bed; heat, either moist or dry, over the

abdomen and epigastrium; counter irritation by a sinapism of mustard or turpentine stupe and hot water internally, in which has been put a few drops of camphor. During the interim put the child on tonic treatment. Fowler's solution in gradually increasing doses of a drop at a time, until the point of toleration is produced, and change of food, scene and air.

ACUTE GASTROENTERIC INFECTION.

Synonyms.—*Acute gastroenteritis, summer diarrhea, summer complaint.*

Etiology.—There is always a causal relation between the food ingested and the development of this condition, infected milk being most frequently the cause in the artificially fed. Statistics universally show the highest mortality rate among bottle-fed children during the first year. It occurs in the breast fed from improper and irregular feeding, and frequently in those partly nursed and partly artificially fed. It is most often seen in the hot summer months though it may occur in winter.

Institution and tenement house babies are frequently affected.

Milk in the various steps of its handling from the cow to the consumer is more frequently contaminated than any other article of food, and being an excellent culture medium both pathogenic and non-pathogenic organisms develop with great rapidity if conditions are favorable. The toxins developed by the bacteria in the milk before and after ingestion are responsible for the majority of the symptoms present as well as for the invasion of the bacteria in the intestinal wall.

Many organisms have been identified in examination of stools from children affected with gastroenteric catarrh or infection. The colon group is most often identified, and Escherich has shown that this group can develop great virulency. Streptococci are also found, especially the streptococcus enteritis which Booker claims is of great importance as a causative factor.

Many other bacteria are found among which may be named the bacillus subtilis, bacillus pyocyaneus, proteus vulgaris.

Pathology.—One who does much postmortem work in these cases will be impressed at once with the small amount of macroscopic changes occurring in the stomach and intestine with the history of such severe symptoms during the last illness.

Microscopically there is found a loss of epithelium in both stomach and intestine, and a general infiltration of the epithelium. Deep ulceration may rarely be found. The mucous membrane exhibits, as a rule, a washed-out appearance with here and there a reddened area, some mucus adhering to surface of the membrane, and the intestine practically empty of contents.

The small gut will often be found contracted almost through its whole extent. Cloudy swelling of the kidney may be found.

Symptoms.—Several forms are described. It may be mild, severe or toxic. Usually without warning the child will vomit, often large quantities, apparently much more than had been taken at the last feeding. In older children there is apt to be nausea for some time after the initial vomiting. There is considerable prostration, the child looks sick, is pale and restless. The temperature rises quickly and may be 102° or 103° F. The stools may at first be normal but are followed by undigested, offensive ones full of mucus.

Prognosis.—In previously normal and healthy children the prognosis is usually good, but in the athreptic baby recovery is not so prompt, and serious sequelæ are apt to develop.

In the very young improvement is usually quite prompt or the child may quickly succumb, or the condition develop into a chronic one.

Treatment.—*Prophylaxis* is of the greatest importance. A breast-fed child should not be weaned in the midst of the hottest months. Only clean, cold milk should be used. If Certified milk is not obtainable the best that can be had should be pasteurized and kept cold until fed. Scrupulous cleanliness of bottles, nipples, etc., should be insisted upon.

As in other gastroenteric disorders the treatment is best considered under (1) Dietetic; (2) Medicinal; (3) Hygienic.

1. *Dietetic.* First all food should be immediately withheld, especially milk, for at least 24 hours. While the nausea lasts, no food by the mouth can be retained or assimilated. Milk in any form should not be given, as no other food offers so favorable a culture medium for bacterial development when taken into the stomach. Dextrinized barley water is better taken care of than anything else, and can be given in small quantities at

the end of 24 hours, or later, if the nausea and vomiting have not stopped by that time. To the barley water can be added a little beef peptonoids or panopepton which makes it more palatable to some, and nutritious also.

On the third day one of the animal broths, plain or with barley water, can be given, and upon the return of normal stools, practically free from mucus, milk can be resumed, at first in the form of whey, made from fat-free milk, and to this may later be added small amounts of skimmed milk, until the usual formula can be resumed. The first milk given may be in the form of buttermilk, made from fresh milk by the addition of the pure culture lactic acid bacteria, and it is frequently well taken by children.

2. *Medicinal.* If much nausea is present, calomel, dry on the tongue, is the remedy of all others. To a child of one year give 1 grain of finely-triturated calomel. If not much nausea is present and the stools show intestinal irritation early a dose of castor oil should be given in order to quickly sweep out the decomposing and putrid intestinal contents.

If much gastric irritation is present and neither remedy can be retained, lavage of the stomach gives brilliant results.

If the initial purgative is given early and dietetic treatment outlined, strictly followed, further medicinal treatment is usually not needed, but if the intestinal irritation continues several doses of bismuth subnitrate may be indicated. The following can be used to advantage:

R Bismuth subnitrat	℥ss
(Merck or Squibb)	
Syr. rhei aromatici	℥iii
Aquæ destillatæ q.s. ad	℥iii
M. (Shake well.)	

Sig. One teaspoonful every two hours, until at least six doses have been given.

To this prescription can be added 5 grains of tannalbin to each teaspoonful if the mucus persists and the evacuations are very frequent.

Colon irrigation once daily with the normal salt solution is of

great benefit, especially early when the nausea and vomiting are features and there is so much loss of fluids.

3. *Hygienic Treatment.* The most important hygienic treatment consists in the proper care of the food of the child from its production until it is consumed; the proper care of the bottles and nipples and the correct modification of the milk for the individual child. Most of these attacks are preventable, and if the parent is correctly informed of the dangers attending carelessness of detail in the preparation and handling of the child's food, a great deal of mortality and morbidity will be prevented.

The child should be warmly clothed, wearing an abdominal binder at all times. It should live out of doors, well protected in inclement weather in winter. Daily baths are most important, and during an attack hydrotherapy for pyrexia is specially indicated. Great care should be taken of the napkins, which should be boiled before using a second time. Regular feeding, according to schedule, is most important and should be insisted upon. It is of as much importance to give accurate written directions in regard to the preparation, care and administration of the food as it is for medicine. Do not take anything for granted when it comes to the feeding of an infant, especially during convalescence from an active gastroenteric infection.

CHOLERA INFANTUM.

Definition.—This term is erroneously applied to many cases of acute gastrointestinal disturbances, which do not all answer the description of this pathologic condition. It is a disease seen in children under three years of age, and is characterized by great prostration, very rapid wasting, profuse watery discharges from the bowel, vomiting of large quantities of fluid, and either rapid improvement as a result of treatment or early death.

Etiology.—No specific organism has been isolated, but the symptoms are those of an essentially toxic disease, viz., rapidly-appearing prostration, high fever, profuse diarrhea and vomiting. It occurs in the very hot weather.

Pathology.—It is surprising that a condition giving rise to such severe symptoms will result in so little gross pathologic changes. No constant changes are found in any organ. The

intestines are collapsed and show a pale washed-out appearance with a denudation of the superficial epithelium. The thin intestinal contents have a yellow color and musty odor.

Symptoms.—This is usually not a primary disease occurring, as a rule, during the convalescence from an acute gastroenteric disorder. There is usually sudden, violent and profuse vomiting, at first the contents of the stomach followed by a fluid vomitus and considerable retching. A diarrhea soon follows, fecal in character at first, the discharges soon becoming entirely fluid, soaking through napkins and protecting cloths as soon as passed. They occur very frequently, every half hour or oftener, have a musty or foul odor, and are practically colorless. But little mucus is passed as a rule.

There is a rapid wasting, the skin is cool, pale and transparent, and soon becomes wrinkled from the wasting; eyes are sunken and rolled up; the child lies at first listless and takes no notice of its surroundings. The temperature rises rapidly, reaching 103° F. to 105° F. or 106° F. in a short while. Rarely cases may be seen in which the temperature does not rise much above normal, if at all, and it is in these that the prognosis is so much graver. The pulse is feeble, rapid and without volume, the respirations are hurried and shallow, the tongue is at first coated but later is denuded of epithelium and becomes red and dry. The abdomen is retracted; the urine scanty; the fontanelle depressed; there is great thirst but water is usually vomited at once after swallowing. Later there may be a shrill cry which is suggestive of meningeal irritation.

Prognosis.—The prognosis is grave in all cases of cholera infantum, no matter how slight they may appear to be in the beginning.

The duration is short, improvement either being very prompt, or a fatal termination inevitable in 24 or 48 hours. Excessively high or a very low range of temperature are grave signs. Some infants die within 12 hours in spite of early and scientific treatment.

Diagnosis.—No other condition met with in the gastrointestinal disorders in children presents so severe a picture of serious illness. The association of severe vomiting, profuse diarrhea,

rapid wasting, high temperature and prostration is sufficient for a diagnosis.

Treatment.—The indications for treatment are very positive, viz., to withhold all food, clearing out of the stomach by stomach washing, and the bowel by purgation and enteroclysis, antipyretic measures, baths or packs. If the wasting diarrhea keeps up, the indication is very positive for the hypodermic administration of morphia and atropia. Give morphia in dose of 1/100 grain to child of one year and repeat for its effect. Atropia can be given in 1/600 grain and repeated as indicated.

Enteroclysis and hypodermoclysis are indicated to renew the fluids lost in the profuse watery diarrhea. Hydrotherapy should be used for the pyrexia, putting the child in the water at 100° F. and cool gradually to 85° or 90° F., being careful to use friction of extremities and body while in the water. Cold compresses should be applied to the head and renewed at frequent intervals during the bath. If the temperature is below normal hot water should be added to the bath to 110° F. The baths should be prolonged for at least 5 minutes. The addition of mustard to the bath water is beneficial. Antipyretic drugs should not be used under any circumstances. If stimulation is needed it should be used hypodermatically, as it is not safe to rely upon the stomach for absorption. No drug will give quicker results than camphor dissolved in olive oil, gr. xx to ʒi, and of this solution giving 10 or 15 minims hypodermatically. The effect of camphor is quick but transitory, and should be repeated or supplemented by brandy or digitalis or strophanthus, 1 or 2 minims of the tincture of either preparation with the brandy.

No food should be given by the mouth until all nausea and vomiting have ceased and the diarrhea is checked. Small quantities of sterile water can then be given, 2 teaspoonfuls at a time every 15 or 20 minutes, and usually this is taken ravenously. If retained a small quantity of dextrinized barley can be given to which has been added a few drops of brandy or a small quantity of panopepton or peptonoids. If the child soon tires of barley water, gruels made from the other cereals can be tried, rice, granum, wheat flour, etc. Later the animal broths can be tried, then whey, to which later, skimmed milk can be added,

after boiling the whey. The milk should best be pasteurized at first. A rise in temperature with a return of the diarrhea or vomiting after the resumption of a milk feeding, is evidence enough that the milk should be discontinued at once, and a purgative given to wash out the undigested masses and the same routine again begun.

If the same experience is encountered on again giving cow's milk, condensed milk should be tried, as this is low in fat percentage, and often can be taken care of when modified cow's milk cannot.

The termination of these cases is either in prompt recovery, early death or a development of a severe enterocolitis.

ACUTE ENTEROCOLITIS.

Synonyms.—*Ileocolitis; dysentery; enteric infection; inflammatory diarrhea and enteritis.*

In this condition there are more or less severe changes occurring in the intestinal mucous membrane, usually without involvement of the stomach.

Etiology.—This trouble is rarely primary, following, as a rule, upon some one of the acute forms of gastric or gastrointestinal disorders.

The Shiga bacillus is very often found, also the colon bacillus and streptococcus. Age plays an important part in the etiology. It is most frequent during the second year, or the much-dreaded "second summer," not because the teeth are being cut at this time but because the child is allowed to eat a too liberal diet during this period and acute gastrointestinal troubles follow. It may complicate the acute exanthemata or pneumonia. Bottle-fed babies are prone to develop this condition. Bad hygienic conditions predispose to its development as do the nutritional disorders, rachitis, scorbutus, and tuberculosis.

Pathology.—As implied by the name given this trouble, the process is limited largely to the colon and the lower portion of the ileum, in a small percentage only the colon may be affected. The stomach may show signs of catarrhal inflammation but as a rule is normal. Three grades are usually described, the mild, or *acute catarrhal; ulcerative; and pseudomembranous.*

1. *Catarrhal*. One is impressed with a condition seen at autopsy in fatal cases of catarrhal enterocolitis, viz., the comparatively slight changes seen macroscopically in the intestines. The stomach and upper part of the small intestine will show changes varying from a very slight congestion here and there, with small amounts of mucus loose in the bowel, or bathing the surface of the mucous membrane, to a deeply-congested area at frequent intervals. The deeply-congested areas are found at or near the cecum. Peyer's patches are swollen, and the general surface of the mucous membrane appears granular. On section the mucous membrane shows a loss of superficial epithelium in some places perhaps approaching the ulcerative stage. There is a general round-cell infiltration of the mucous membrane causing thickening and some swelling of the lymph nodes.

2. *Ulcerative*. In this form there may be a follicular ulceration, being limited to the solitary follicles or a coalescence of a number of these forming a large ulcerated area. The ulceration may also involve a large area and be of a catarrhal variety entirely, and quite superficial. Ulcers are rarely found above the lower 12 or 15 inches of the ileum, and are chiefly located in the colon. In those areas where the follicles have coalesced the destructive process is deep, penetrating to the muscular coat, but in the milder form it is superficial. The mucous membrane has a pitted appearance.

3. *Pseudomembranous*. In this form also the process is chiefly located in the lower ileum and most of the colon. There is a general thickening of the intestinal wall, due to round-cell infiltration, congestion and attachment of the pseudomembrane. The whole surface of the colon may be covered with membrane or only a portion of it, with deeply-congested areas here and there, from which the membrane has become detached. The process is rarely found in patches, but it may be limited to the extreme lower end of the colon and the rectum.

The pathological changes found elsewhere depend entirely upon the complications existing during the attack. It is not an unusual thing to have a patchy bronchopneumonia, especially in the prolonged cases, and in those who are reduced in vitality,

the athreptic, marasmic child being much more liable to develop such complications. Nephritis may very rarely occur as a complication.

Symptoms.—Clinically, it is often very difficult to differentiate the three varieties of this condition described under pathological changes. I have seen cases with a large number of mucous, bloody stools, with other symptoms indicating a severe ulcerative type, in which the autopsy findings did not reveal any changes usually in the ulcerative type.

If primary, an enterocolitis usually begins suddenly, with vomiting, a rise of temperature varying from 102° to 104° F., with proportionate increase in pulse rate, and the child appears sick from the onset.

The vomiting as a rule is not severe or often repeated, and is soon followed by abnormal evacuations. The first part of the first stool may be normal, the last loose, perhaps containing undigested food and mucus. The character of the movements rapidly changes, they are frequent, perhaps averaging once an hour; thin, contain much mucus, and vary in color from a very dark yellow to many shades of green. Some of the stools may consist simply of glary mucus. They may or may not, in the severe cases, contain blood varying from a few streaks in the mucus to a larger quantity. The stools will change in color, after being passed, and when a napkin is examined the hour it was soiled should be known. After standing they frequently become very green in color, turning from a light brown to a very much lighter shade of green. Frequently there is tenesmus with each stool, the rectal mucous membrane may protrude as the child strains. The mother will often state that water or nourishment of any kind “passes directly through,” meaning that the ingestion of anything causes peristalsis and a movement results. If there is much toxemia and high temperature the child will probably lie in a stupor; with a lower temperature it is apt to be fretful and restless.

It is not infrequent that they have muscular twitchings or general convulsions.

The high range of temperature is usually of short duration, there being an elevation of 2° or 3° F. during the rest of the acute

stage. As a result of the toxemia, frequent loose actions, long febrile course and restricted diet; there is rapid wasting, the eyes become sunken, the skin is wrinkled and the fontanelle sunken, the picture presented being anything but a promising one. Thirst is apt to be a prominent symptom.

Course and Duration.—The duration in the severe form of enterocolitis is usually comparatively short, the child growing rapidly worse from the onset, terminating fatally within a week or 10 days, or the acute symptoms subside and the convalescence is prolonged for several weeks, or an improvement follows promptly from the acute symptoms and the child succumbs to a complicating bronchopneumonia.

Cases may terminate fatally in three or four days, in spite of diet and treatment.

Milder cases are more often seen, but the general symptomatology is the same, a less abrupt onset, not so frequent vomiting, fewer stools, but they have the same general characteristics, nervous symptoms less marked, convulsions unusual, and the general duration is shorter. The acute symptoms usually end in about a week, and the convalescence while slow is steady. Indiscretions in diet result in very frequent relapses and a chronic enterocolitis is the natural sequence. This is especially true when milk feedings are resumed too quickly and in prescriptions too rich in both fat and proteids.

Prognosis.—Several factors materially influence the prognosis. The younger the child the more grave the prognosis; severe attacks under six months are usually fatal.

Artificially-fed infants bear an attack poorly; in the athreptic and poorly-nourished the results are poor; cases in which a digestive disturbance has been neglected always do badly, hence the prognosis is decidedly better when treatment is begun promptly.

Treatment.—As just stated, on the promptness with which treatment is instituted in these cases depends in a great measure the results. The treatment can be considered under four heads; 1, preventive treatment; 2, general and dietetic treatment; 3, medicinal, and 4, hygienic treatment.

1. *Preventive.* Neglect of apparently trivial attacks of

gastroenteric disturbances, continuance of the usual diet in the presence of what is generally considered a trivial attack of vomiting and diarrhea, is responsible for more of these cases than any other cause, and undoubtedly increases the mortality greatly.

Mothers should be educated in the first place in the importance of a pure milk supply in the artificially fed, the value of absolute cleanliness in the care and preparation of the child's diet; the necessity for the immediate withdrawal of all food upon the first appearance of vomiting or an abnormal stool and early medical treatment. If these requirements were met in all cases, the frequency of the severe cases and the mortality would be greatly reduced.

2. *General and Dietetic.* If the vomiting is recurrent the stomach should be washed, using warm, filtered and boiled water. If on a general diet or modified or whole milk, *all food must be withdrawn at once*, and not resumed until both the stomach and intestines have had a rest, and then resumed very gradually. The first food given should be a dextrinized plain barley water or combined with any of the animal broths, in equal parts, or a small quantity of panopepton or liquid peptonoids. The latter are of value chiefly because of their alcohol content, having relatively small food values. Milk can be resumed after the subsidence of the symptoms by the use of whey, made from fat-free milk, combined with barley water or a diluted fat-free buttermilk made with a pure culture of lactic acid bacteria. Beef juice has a tendency to increase the diarrhea, often causing watery movements. The food must be changed from time to time also, as the child is apt to become tired of one or two of the combinations mentioned. If it refuses food entirely, it must be given by gavage. Do not resume milk feeding too suddenly; add 1 or 2 drachms of skim milk to a barley-water feeding, once during the day; if this is taken care of give the same quantity twice the next day, the next give 2 teaspoonfuls, and so on, gradually increasing the milk.

A valuable agent, but a much-abused one in these cases, is colon irrigation. It need not be used oftener than twice in the 24 hours, once being usually sufficient; a soft Nelaton catheter,

well anointed, should be used, and if there is much straining and a tendency for the bowel to expel the tube, the irrigating bag should be held but a small distance above the buttocks. If there is much mucus of the white, glary kind, the irrigation can be of an astringent solution to advantage, a heaping tablespoonful of tannic acid, dissolved in a quart of water. For an ordinary irrigation use the normal salt solution, using not less than 2 quarts at one irrigation. The temperature can be as low as 85° F. in febrile cases, or 95° to 98° F. where the temperature is not so high. Tub baths are given for cleansing purposes as a routine, but should be repeated as an antipyretic measure. Medicinal antipyretics should never be used.

3. *Medicinal.* Shotgun diarrheal prescriptions should never be given. Only such drugs should be used as there is a special indication for. As soon as the first symptoms appear a purgative must be given, castor oil, if the stomach is in condition to retain it, otherwise calomel, in 1 grain doses to a child of one year or over. One of the most useful is bismuth and a pure subnitrate preparation is advised. The usual dose given by the average practitioner is much too small. It should be given in not less than 10 grain doses until at least 60 to 80 grains have been taken in 24 hours. It is a valuable agent, acting mechanically on the congested and inflamed mucous membrane. An astringent can be added if the movements are very frequent and contain much mucus. Tannalbin or tanningen in 3 to 5 grain doses can be added to the bismuth for their astringent effect. If there is much odor to the evacuations salol will be found of service, given in 2 to 4 grain doses every four hours.

Stimulation may be needed, but should be reserved for active indications. Hypodermatic injection of strychnia sulphate gr. 1/200 or atropia sulphate gr. 1/400 may be given.

Opium is of service in those cases with very frequent movements and a great deal of tenesmus. Dover's powder, in 1/4 to 1 grain doses, is a valuable remedy. Opium in any form should not be combined with a prescription, but ordered separately and given at the same time if need be. This is important, as the opium is usually the first remedy to be discontinued. Kerley has recommended the addition of 1 grain of sulphur to the bis-

muth preparation, if the movements do not turn black after its administration for a few days. For the tenesmus, 3 or 4 drops of the deodorized tincture of opium can be given in 2 or 3 drachms of starch water as an enema, following an irrigation, if the Dover's powder is ineffective.

The after-care of these patients is most important. Medication in convalescence is not specially indicated, as they usually respond quickly to proper diet as soon as it is safe to resume it.

4. *Hygienic.* In no class of cases does a complete climatic change have so beneficial an action as in children convalescing from enterocolitis. From points south of Mason and Dixon's Line no other change is more beneficial than removal to points in Michigan. The large amount of water through this State imparts a life-giving something to the air which works wonders in these cases. They unquestionably get back upon a gaining diet much quicker in this climate than at home. Some cases do well when simply moved from the city to the country nearby—others do better in the mountains or at the seashore.

Great care should be exercised in keeping the soiled napkins clean. They should be boiled daily. In institutions the napkins from the well should be treated separately from the infected ones. These cases should be isolated in hospitals and institutions, and not too many kept in a ward or room. Their feeding utensils should be kept apart from the general supply and frequently boiled.

If in institutions but few should be put in the same ward, allowing plenty of air space to each infant.

CHRONIC ENTEROCOLITIS.

Synonym.—*Chronic Gastrointestinal Indigestion.*

Acute enterocolitis frequently ends in the chronic form. The acute symptoms subside, or perhaps the child shows a decided improvement, it is fed indiscreetly, and a second attack follows, which lapses into the chronic form. It is found in hospital cases of acute form which have improved and been allowed to return to unhygienic homes and bad food, with the chronic condition following.

It may be seen at any age of childhood, an inflammation of

the colon alone being more frequent, however, in older children.

Pathology.—There is usually a catarrhal inflammation of the mucous membrane of the colon, and the last 10 or 12 inches of the ileum. The inflammatory condition extends into the tubular glands and many of these are destroyed by pressure. There may rarely be an ulceration of the mucous membrane. The mesenteric glands are enlarged.

The most frequent complication in this form of trouble is a pneumonia, hence we find the lungs involved to various degrees, from a hypostatic condition to consolidations here and there through the lung, of the bronchopneumonia type.

Symptoms.—The chief general symptom is a more or less rapid and progressive loss of weight, with abnormal evacuations numbering 6 to 10 in the 24 hours, or there may be twice as many. The stools are abnormal in color, content and consistency. They may be mushy and be composed mostly of a greenish mucus, or they may lose all color and be light and contain pus. They may or may not contain blood, usually do if there is much straining. The color varies from a yellow to a brown, with all shades of green. If on milk or a general diet, curds and undigested food are present.

The child quickly develops into that condition known as *athrepsia* or malnutrition, it emaciates quickly, its abdomen is distended, it is restless, fretful and cries a good deal, the fontanelle is depressed, skin wrinkled, and it soon develops the old-man facies, with tightly-drawn skin over the face. It lies upon its back or side with legs drawn up, the skin of the legs and arms is in folds, and there is no subcutaneous fat. The temperature is below normal, and may reach but 95° F. in the rectum. Owing to the many discharges the skin of the buttocks may show an intertrigo, or at least a severe redness. Food will be generally taken with greediness. The pulse is weak, the feet and hands cold. Occasionally, shortly before death, the feet and hands may be quite swollen.

Diagnosis.—The chief trouble to be differentiated is from tuberculosis, and in the absence of marked intestinal disturbance this may be difficult. In those cases which have a distinct tubercular family history, and in certain hospital cases it may

be more puzzling. It probably cannot be positively determined without the use of tuberculin which is one of the diagnostic methods advised. When there is distinct involvement of the chest the diagnosis of tuberculosis is easier.

Prognosis.—This is universally bad. While some cases may show an improvement even after several weeks of an apparently hopeless condition, the majority succumb. The prognosis is influenced by the age, surroundings, intelligence of mother or nurse, and feeding. The prognosis in children under one year of age is very grave.

Treatment.—1. *Hygienic.* Fresh air and a change of climate, if possible, is of prime importance. The remarks on page 275 relating to climatic change in the treatment of acute enterocolitis is true in the chronic form. If thoroughly protected from exposure, the child should be out of doors almost continuously. Regular baths should be given, but without exposure. As described in the previous section the napkins should be carefully washed, and the child changed promptly when one is soiled. An abdominal binder should be worn in addition to the shirt. The binder in the form of the sleeveless shirt, made with shoulder pieces and tapes in front and back to pin to the napkin, is best. Stockings should always be worn and flannel skirt also.

2. *Dietetic.* In no other condition are precise instructions in regard to feeding so necessary. Written directions as to choice, mode of preparation, time, temperature and quantity of the food should be given the mother. The diet should be concentrated, leaving little residue. The digestive capacity for carbohydrates, fat and proteid is much enfeebled, and food within reach of the digestive capacity should be given. Fat-free whey; animal broths with fat removed; dextrinized cereals; predigested milk, when it can be borne, are the foods which can be tried. If one seems to cause a recurrence of the condition it is discontinued. Regularity of feeding is most important, not oftener than every two hours, and food given in 2 or 3 ounces at a feeding. Over-feeding is greatly to be feared. If the child shows an improvement eggs can be added to the list, peptonized milk, lactone buttermilk, scraped beef, etc. A gain in weight, or if it stops

losing with coincident improvement in the stools, is an assurance the child is improving.

3. *Medicinal.* Castor oil at the onset and repeated occasionally is a valuable agent, 1 or 2 teaspoonfuls to an infant of one year. An emulsion of castor oil containing 10 drops to a dose is frequently beneficial. If not retained calomel in 1 grain dose should be given.

The same directions as to the administration of opium in the acute form obtain in the chronic. It should not be combined with any other prescription. Dover's powder, in $\frac{1}{8}$ to $\frac{1}{4}$ grain doses, or paregoric, 10 or 15 drops, are the best preparations. Bismuth is a valuable agent and can be given plain or in combination with tannalbin, if an astringent is needed, and salol, if there is much fermentation and odor present. Astringent injections should be given when there is much mucus, otherwise a colon irrigation of normal salt solution, under the same general rules as mentioned before.

Stimulants should not be given unless there is a decided indication for their use. Cod liver oil, internally, is of great service in convalescence when tolerated by the stomach, and frequently it can be taken when no other fats can be borne.

CONSTIPATION.

Constipation is a symptom, not a disease. It is more or less a relative term, but it exists when the bowel movements occur less frequently than is ordinary; when it is accomplished with difficulty, when the fecal matter is reduced in quantity, and is drier than normal. This is a common affection in children.

Etiology.—The chief cause of constipation in infancy is the conformation of the colon, especially the sigmoid flexure. Owing to the shallow infantile pelvis and the relatively long mesentery of the sigmoid, this portion of the large bowel is freely movable, often found beyond the middle line of the abdomen. During the first few months after birth the descending colon grows at the expense of the sigmoid and the apparently superfluous sigmoid is shortened. Because of this freely movable length of colon just above the rectum, it acts as a storehouse for fecal accumulations and is with difficulty emptied. Its contents move

slowly and absorption takes place readily, causing increased dryness of the fecal mass. Added to this is the distension which comes from fermentation, rendering movement less likely to occur.

Constipation beginning soon after birth, especially when associated with vomiting should cause pyloric stenosis to be suspected. The fear of pain caused by a fissure may be a voluntary cause of constipation.

Late in childhood after typhoid fever, or an attack of appendicitis, constipation is probably due to bands of adhesions acting as a mechanical cause of constipation.

Dietetic causes of constipation should be carefully considered. A deficiency in fat, in both breast and modified milk, with a relatively large proteid percentage is a cause. Too long continuance of a milk diet in late childhood and the absence of mixed food, carbohydrates, etc., may also act as a cause. Too little water in both the artificially and the breast fed; prolonged use of a Pasteurized or sterilized milk may act as causes.

Loss of muscular tone, such as follows the acute exanthemata, typhoid fever, or as is found in rickets and athrepsia, is a frequent cause. Failure to begin with regular habits and encouragement to have daily evacuations at a regular time will cause constipation. It often follows an attack of acute enterocolitis, due sometimes to the too prolonged use of astringent drugs in the treatment of the acute condition. The use of soothing syrups, all of which contain opium, for the cure or alleviation of colic is a potent factor in the development of chronic constipation.

Symptoms.—A normal number of evacuations is a purely relative term, for what is normal to one baby is not to another. One child may be entirely normal with one evacuation and another may have two natural daily movements and be uncomfortable without that number.

The infant will normally have from two to four soft movements; later from the fourth to the sixth month they become less frequent, perhaps only two a day, and during the latter half of the first year the constipation usually begins. It will have one natural action a day, or it must be assisted to have

that. If it has the one action a day and this is firm and hard, it is constipated.

When a child has not had a movement for one or two days it may or may not present symptoms. It is, however, apt to be fretful and cross, there may be colic, nearly always flatulency, with distension of the bowels.

Occasionally a case may be seen which has passed several large, firm, hard movements which have so stretched the sphincter muscle as to cause the mucous membrane to tear. This does not heal, and a fissure of the anus results. Because of the pain caused by a movement when a fissure is present the child voluntarily suppresses an action of the bowels and will not sit upon the chair or vessel. The pressure of the accumulated fecal masses in the rectum causes a passive congestion of the hemorrhoidal plexus of veins and hemorrhoids result. A prolapsus of the mucous membrane may also occur as a result of the straining. In some cases as a result of acute constipation, especially when previously regular actions have obtained, there may be vomiting with a slight rise of temperature of 2° or 3° F. They are restless, cross and peevish, have little appetite and sleep poorly.

Prognosis.—This is variable, depending upon the cause, age of child, duration, presence of complications, etc. Usually, however, it is fairly good and by faithfulness in carrying out directions will good results be had.

Treatment.—The chief indication is regularity in obtaining evacuations from the bowels. As early as six months the child must be taught to use the chair or vessel. It should not be allowed to sit too long upon these, because of the tendency to development of hemorrhoids. If there is no inclination in 15 minutes to strain and assist the movement, a glycerine, pencil suppository or small amount, 8 or 10 ounces, of water thrown into the rectum from a fountain syringe, held about 3 feet above the child should be used. In using the syringe it is well to attach a soft-rubber catheter to the hard-rubber syringe tip in order to avoid injury to the rectum in its introduction. This will cause the child to strain to expel the suppository or water, and an evacuation results.

Endeavor to locate the cause of the trouble. If it is dietetic, as indicated in the description of the etiology, correct this. If the mother's milk shows by an examination an excess of proteids, have her eat less meat, take more exercise and drink more water. If the child is on modified milk increase the fat content in the prescription, or if the age will permit, begin the varied diet and increase the amount of water taken. The average child, whether breast or artificially fed, is given too little water.

The use of dextrinized gruels is of service as a diluent when modified milk is given, especially an oatmeal water or one of the flours made by the Cereo Company, Tappan, N. Y.

Abdominal massage is of great benefit, beginning the rubbing in the right iliac fossa, extending from this point over the course of the colon. This should be done with the child upon its back upon a firm mattress.

In the athreptic or marasmic infants, especially, and to others also, the administration of orange juice is of great assistance in this condition. The juice of half an orange can be given twice a day, not too close to a milk feeding.

In children after the second year good results are obtained from giving muffins or biscuits made from whole wheat flour, plain or mixed with bran. Cooked fruits are of value also, as stewed prunes and apples. Spinach and asparagus can be given older children to advantage.

Medicinal. Medicine should not be resorted to until all other means of treatment have been exhausted. Of all the remedies suggested for constipation cascara sagrada is one of the most serviceable. It can be disguised by aromatics without its efficiency being destroyed. Almost any of the aromatic preparations can be used to advantage. It acts as a tonic to the intestinal musculature, and from the maximum dose (20 to 60 drops), if used in connection with dietetic and other measures, can be reduced in a short time to the minimum dose (10 drops), and then discontinued.

An occasional dose of calomel is of benefit, especially when the actions are very light in color. Rhubarb and soda can often be used to advantage as follows:

R̄ Pv. rhei 3iss
 Sodii bicarbonat 3i
 Syr. tolutan 3i
 Aquæ destillatæ q.s. ad 3iii
 M. ft. Sol. (Shake.)

Sig. One teaspoonful once or twice a day.

Syrup of tamarinds is of benefit used as cascara, 1 or 2 teaspoonfuls at a dose, at bedtime, usually but one being required.

Sodium phosphate, plain or effervescent, taken in the morning before breakfast, well diluted, in certain cases is of benefit. Two to five grain doses of carbonate of magnesia may be effective.

In cases in which there is an impaction of the rectum and sigmoid an injection of first, a stimulating enema containing a half ounce of glycerine and of Rochelle salts can be used. If this is not successful, an emulsion of 6 ounces of fresh ox gall in 1 pint of warm water may be effectual, or the injection of 6 ounces of molasses and enough milk to make a pint may be tried.

Phenolphthalein, in $\frac{1}{4}$ to 1 grain doses, may prove efficacious if other remedies fail.

DILATATION OF THE COLON.¹

Synonyms.—*Congenital idiopathic dilatation of the colon; Hirschprung's disease; giant colon; Mya's disease; mega colon.*

Etiology.—This is a congenital condition. Those cases described in adult life (pseudomega colon) are believed to be delayed development of the congenital type or another condition entirely, due to aggravated constipation.

A number of theories have been advanced as to the etiology of this condition, none of which are convincing. The following have been suggested as causes: A neuropathic dilatation and hypertrophy; increased length of the colon; a valve formation in the intestine; spastic contraction of the sphincter ani; abnormally long mesentery of the colon; chronic colitis, etc., etc. Boys seem more often affected.

¹ I am indebted to the excellent article of Dr. J. M. T. Finney, upon this subject in *Surgery, Gynecology and Obstetrics*, June, 1908, for much data in this section.

Pathology.—The process in the majority of cases is limited to the sigmoid flexure. The diameter of the dilated portion may reach 6 or 8 inches, and it fills most of the cavity. The walls show dilatation and hypertrophy. The mesocolon is thickened and of irregular lengths. The blood vessels and lymphatics are

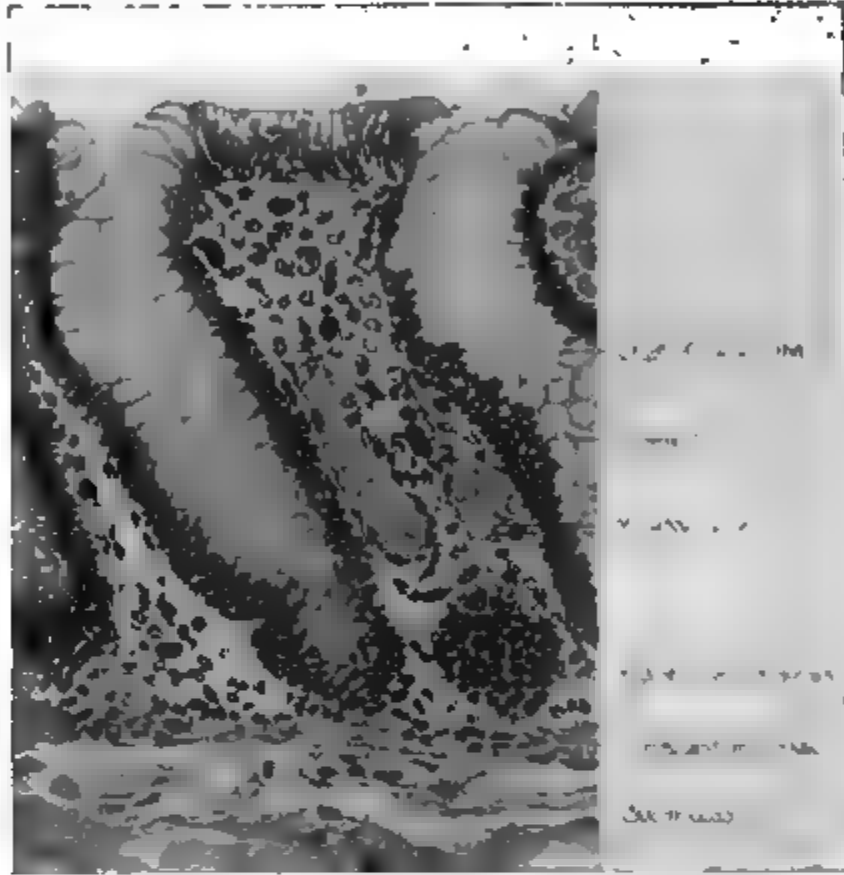


Fig 50.—Mucosa normal colon. $\times 800$

much dilated. The mucous membrane is thickened, congested and occasionally ulcerated.

Microscopically the mucous membrane shows chronic inflammation. The circular muscular layer is enormously thickened, and the serous coat thickened with enlarged lymphatics and blood vessels.

Symptoms.—Enlargement of the abdomen, the most prominent symptom, associated with obstinate constipation, is present early in life. The large abdomen may be noticed at birth, but the child may be several months old, perhaps several years before the condition becomes very marked. The abdomen is then enormous, the distension of the colon being due to gas and feces. History of a long period between evacuations of the bowels may be obtained, one case reported as three months.

The skin is harsh and dry, complexion pasty, abdominal wall thin, through which peristaltic waves can be seen; the veins of

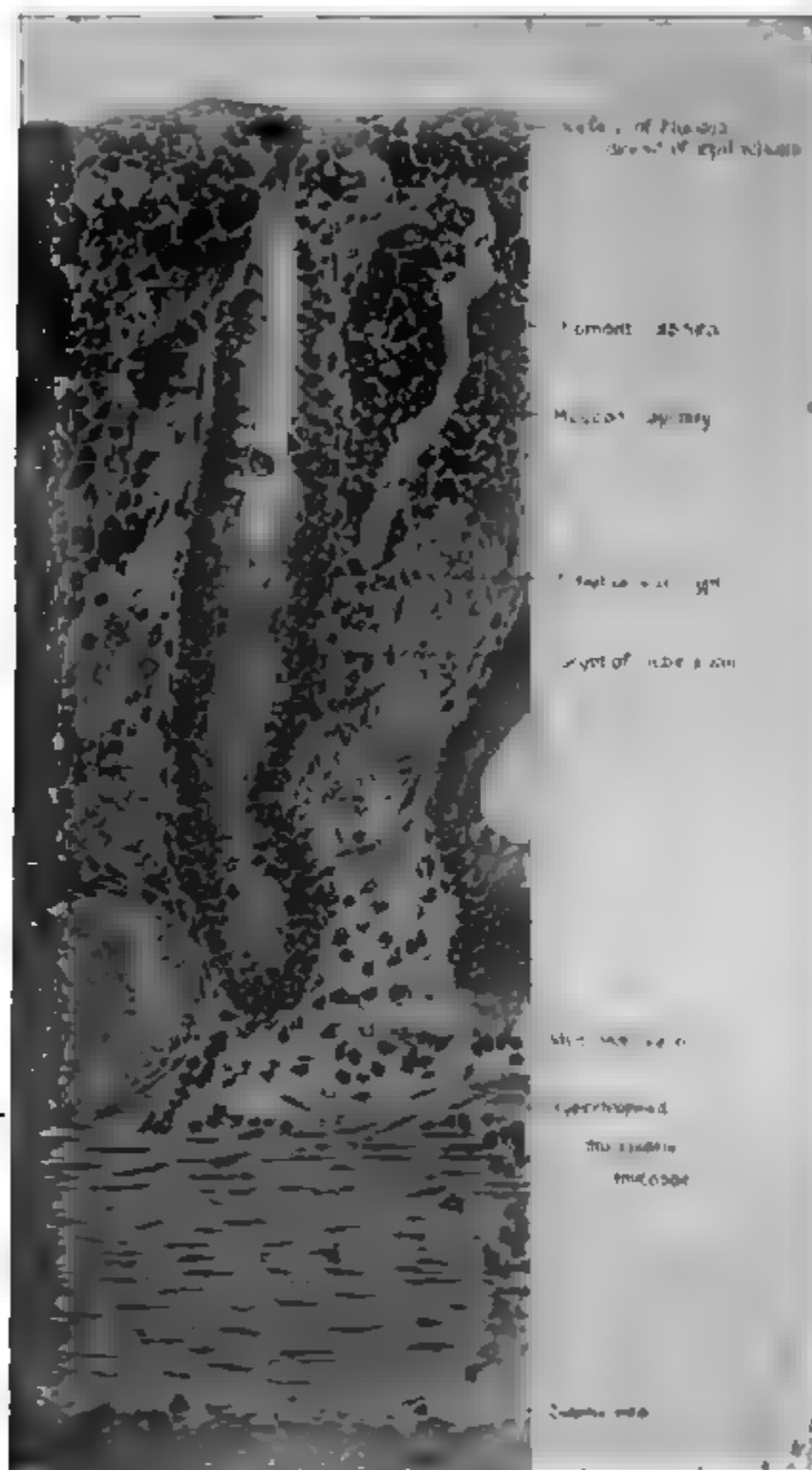


Fig 51 Mucosa giant colon $\times 370$.

the skin are distended. Tympanites is quite general over the abdomen, the liver dulness decreased.

The movements from the bowel are apt to be dry or putty like, dark in color and offensive.



Fig 52 — Congenital idiopathic dilatation of the colon.

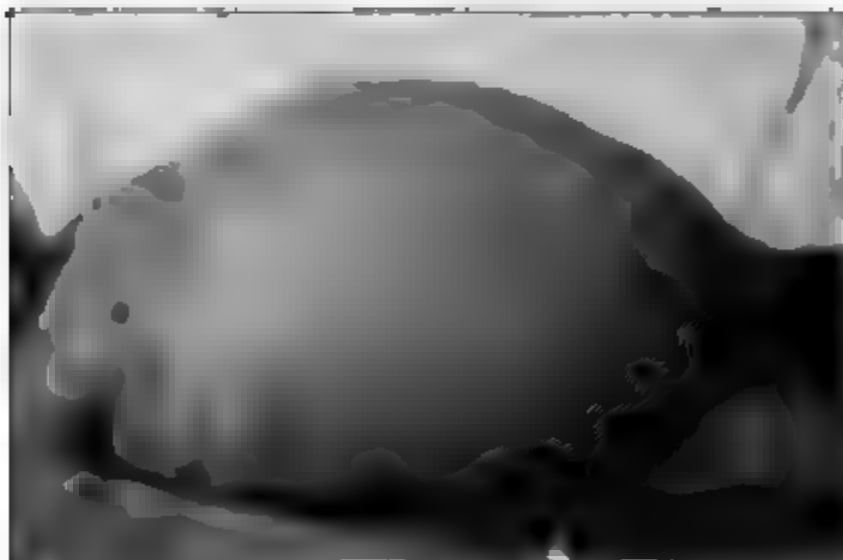


Fig 53 — Side view of same patient as Fig 52.

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1 Figs 50, 51, 52, 53 reproduced through the courtesy of Dr. J M T Finney, Baltimore, from *Surgery, Gynecology, and Obstetrics*.

Dyspnea may, late in the trouble, be quite marked, and bronchitis and pneumonia may be present. Atelectasis may be found in the lower portion of the lung. The pulse may be irregular. A cone-shaped dilatation of the bladder has been noted. The course of these cases is essentially chronic. There is an apathetic condition.

Diagnosis.—Meteorism and chronic obstipation are the two symptoms practically always present. It must be diagnosed from tubercular peritonitis, volvulus, carcinoma of the intestine.

Prognosis.—While not fatal directly, the complications present may bring about death. Pulmonary heart and digestive disturbances may result fatally.

Treatment.—This is either surgical or medical. Surgically, the following procedures have been suggested: Puncture of the intestine (under no conditions to be done); colotomy, with evacuation of the contents and closure; colostomy; colopexy; enteroanastomosis; resection of affected portion and enteroanastomosis.

Medically, the following measures have been suggested: Cathartics, enemata, massage, electricity, tonics, exercise, diet, etc. The mortality rate is given as follows: "Surgical treatment has a mortality rate two-thirds that obtained by medical measures and a recovery rate almost three times as great."

CHAPTER XIII.

INTESTINAL PARASITES.

Intestinal parasites are comparatively infrequent, yet it is a common belief among the laity that every child which picks its nose or grits its teeth at night is affected with them. Because of this deep-rooted belief the subject is of considerable importance. Among the facts elicited in regard to the child's history is, that it has been given some "worm medicine" before the physician has been consulted.

Intestinal parasites are not seen in very young infants, but are found in children after a mixed diet is given, or after it crawls around on the floor, putting things in its mouth picked up from the floor.

Varieties.—The following intestinal parasites are found in children: the *Nematodes*; the pin-worm, *oxyuris vermicularis*, whose habitat is chiefly the sigmoid and rectum; the round worm, *ascaris lumbricoides*, found chiefly in the small intestine, and often in the stomach; the hook worm, the *ankylostomum duodenale* or *uncinaria duodenalis*, as the name implies, found chiefly in the duodenum; the *cestodes*, the two species of tapeworm, the *tenia solium*, the pork worm and the *tenia mediocanollata*, the beef worm.

OXYURIS VERMICULARIS.

Synonyms.—*Pin-worm*; *threadworm*; *seatworm*.

Description.—The habitat of this worm is chiefly in the sigmoid and rectum, the female worm, however, being found near the cecum. The worms and ova are passed in large numbers, in the feces and when entangled in masses can be easily seen. In girls the vagina may become infected from the discharges. They are very small in diameter, the female the longer, about 10 or 12 mm. in length, the male 5 mm. The ova are quite small, symmetrically oval in shape, .05 by .02 mm. in dimension.

The mode of infection is by means of fingers, toys, fruit infected with the ova, these being carried to the cecum in the food and there develop. They do not need an intermediary host.

Symptoms.—The chief symptom is the intense itching of the anus, produced by the worms in the rectum. The child is very restless, both day and night, and is constantly scratching about the buttocks. A catarrhal condition of the rectum may ensue. If they migrate into the vagina a vulvovaginitis results. Incontinence of urine may occur from the irritation of the bladder. In males an irritation of prepuce may result with swelling and

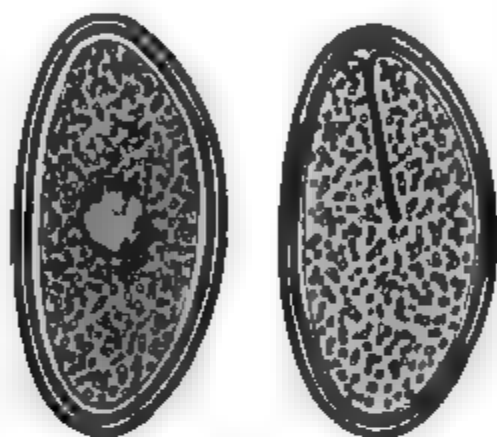


Fig. 54.—Eggs of *oxyuris vermicularis*.

pain on voiding. The skin about the anus and buttocks shows evidence of scratching.

Diagnosis.—The anus and stools should be inspected in every case of pruritus, and if carefully done the worm will often be found. An enema should be given and the water returned carefully examined. In every case of masturbation the presence of threadworms should be suspected.

I had under observation a child whom I had previously seen in two severe attacks of enterocolitis, with large quantities of mucus passed for a long period of time. Upon the first appearance of mucus in the movements after this, I was notified. Inspection of what was thought to be mucus in a movement proved to be a mass of threadworms. The diagnosis was verified by microscopic examination. In this case the worms had not been present long enough to cause any symptoms.

Treatment.—The chief reliance in the treatment of these cases must be had in the use of injections into the colon through a

long colon tube, as the habitat of the worm is below the cecum. The treatment must be thorough or the results will be correspondingly poor. First, a preliminary dose of *ol. ricini*, 3ii, should be given, and this followed by a high cleansing, saline enema, of not less than 3 pints. After this solution has been allowed to pass through the tube and with the child on the vessel, the tube is reinserted and an injection of 1 ounce of the infusion of quassia and 15 ounces of the normal salt solution given high, the tube quickly withdrawn, the nates compressed and the child kept quiet so this injection will be retained for at least an hour, if possible. This treatment is repeated each night for a week, at the end of which time a careful examination should be made of the stools, microscopically for the presence of ova.

It should be remembered also that the ova become attached to the skin about the anus, and when scratching the fingers of the child can become infected, and they in turn carry the ova to the mouth, and a reinfection takes place. Hence, extra precautions should be taken in cleansing the nates after evacuations, and the constant application of a 10 per cent boracic acid ointment about the anus and skin surrounding. Care must be taken also of the napkins, night clothes and bed clothes, boiling after each removal.

ASCARIS LUMBRICOIDES.

Synonym.—*Round Worm.*

Description.—As indicated by its common name, this worm is round and smooth, being usually from 4 to 12 inches long, and tapering at both ends to a point. This worm is perhaps the one most frequently seen in children. The female is nearly twice as long as the male, the head having the projections, and provided with fine suckers and teeth. The tail of the male is turned upward. The ova are round, brownish in color, slightly larger than the ova of the threadworm.

There may be only one worm present, but usually there are several. I have had one case in which two were vomited and 88 passed per rectum.

They may be found at any point tributary to the intestine; in the stomach, from which it is usually vomited, at any point in

either large or small intestine, in the appendix and the gall duct and bladder. They may coil themselves together and form a mass of sufficient size to cause an intestinal obstruction.

Symptoms.—Large numbers of the worms may be present and cause no symptoms. The child mentioned which passed 88 was ill with malaria with high fever, worms were not suspected until the first one was vomited. The fever acted as an anthelmintic on the others as they passed from the bowel soon after.

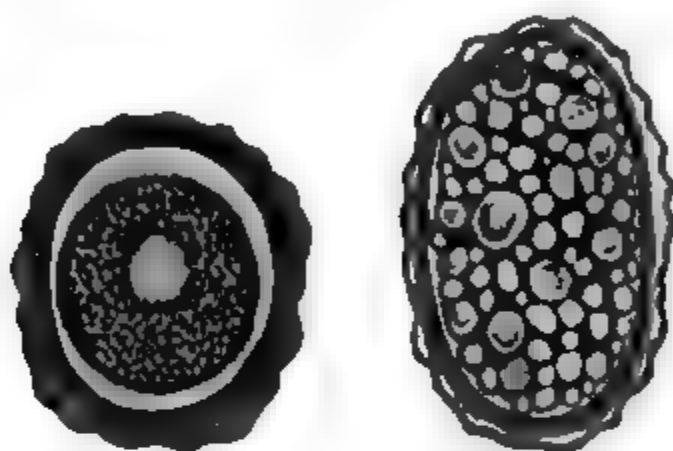


Fig. 55.—Eggs of *ascaris lumbricoides*.

The presence of an eosinophilia has been pointed to as a prominent symptom.

The vague symptoms referred to above may be present, but they have no significance as a diagnostic aid at all, being caused entirely by other pathologic conditions. The first symptom is the presence of the worm. The symptoms believed to be common by the laity are restlessness at night, flatulency, picking at the nose, grinding the teeth, headache and convulsions.

Diagnosis.—As intimated, the only reliable diagnostic sign is the presence of the worm, either vomited or passed per rectum. In this event examination of the feces, microscopically, will reveal the ova in large numbers.

Treatment.—One of the most reliable vermifuges is santonin. It may be given in connection with calomel.

R Santonin

Hydrargiri chloridi mitis aa gr. i

Triturate thoroughly. Ft. Cht. No. iv

These are best given in the morning before breakfast, the

child having had a very light supper the evening previous. This should be followed by a dose of castor oil (℥ss) in four hours. On the second day following, the stool should be examined for the presence of ova. Toxic effects are sometimes obtained from santonin, hence it should always be given in small doses and if need be repeated.

ANKYLOSTOMUM DUODENALE.

Synonyms.—*Uncinaria duodenalis*; hook worm disease.

Description.—The natural habitat of this worm is in the far south countries, but it occurs with fair frequency in this country in the Southern States.

In 1893 Blickhahn¹ reported a case in St. Louis, and in 1898 Dabney reported a case in New Orleans, and Tebault another in the same city a year later. In 1902 Harris claimed that a number of cases of anemia in Georgia, Alabama and Florida were due not to malaria, as universally believed, but to uncinariasis.

Stiles states: 1, uncinariasis is pre-eminently a disease of sandy localities; 2, infection occurs chiefly in rural districts, but this is true simply because it is in such districts that less attention is given to the disposal of fecal matter and because more people in such localities are brought into contact with the soil; 3, whites are more often and more severely infected than negroes; 4, infection, as a rule, takes place in more than one member of a family; 5, children and women show a more severe infection than men; 6, in hot weather the symptoms of the disease are exaggerated.

The embryos may exist for a month outside the body and develop in a host. Pollution of the soil from improper disposition of the feces is the cause of its dissemination. It is seen in dirt eaters; and an infection can occur from uncooked food which is taken by the child. The majority of these worms are found in the second portion of the small intestine, and are present in large numbers as a rule.

Symptoms.—The symptoms in the host of the hook worm are believed to be due to a toxemia, chief of which is a profound anemia; the subjects are thin and pale, with muddy complexions,

¹ Dock: Loc. cit.

the abdomens protrude and they have no endurance and tire easily. There is palpitation and dyspnea, headache and dizziness are often present; they are dirt eaters and have perverted appetites; have no ability to acquire knowledge or to work. They are listless, idle and shiftless. Disobedience, cunning, lying, stealing and other symptoms ordinarily attributed to hysteria are seen. The bowels are constipated and what is passed is often blood stained; the abdomen is often much distended. Hemoglobin is reduced out of proportion to the diminution in red cells. Hemic murmurs are heard.

Diagnosis.—The patient presents a rather typical picture, and the diagnosis can be confirmed by microscopic examination of the stools for the ova or the parasite can be seen by the eye. The ova are much larger than a red blood corpuscle, and have a colorless capsule. The parasite is half an inch long, size of a hat pin, and one end hooked back on itself. Stiles suggests the blotting-paper test for diagnosis, 'about an ounce of fresh feces are placed on a piece of white blotting paper and allowed to stand an hour. The feces are then removed and the color of the stain examined. In a large percentage of cases of uncinariasis the color is reddish-brown and reminds one of blood stain. This test is not considered reliable.

A second test is a therapeutic one. Thymol is administered and the parasites are found in the stools.

Prognosis.—This is good if the case has not progressed too far and the anemia too profound.

Treatment.—Snyder¹ recommends a preliminary dose of magnesium sulphate. Thymol, finely triturated, is given at 4 p. m. and at 8 a. m. the following morning in dose of from 5 to 20 grains, in capsules, on an empty stomach. This is repeated at 10 o'clock and the dose of magnesium sulphate given at 12 o'clock. One or two, perhaps more, courses of thymol may be needed to control the condition.

Nourishing food and iron tonics are given too for the anemia, one of the best of the latter being diastiron in teaspoonful doses after meals. Nux vomica is of service. The children should be removed from school.

¹ Pediatrics, December, 1908.

CESTODES-TENIA

Synonym.—Tape-worm.

Description.—The life history of the tenia is the ova, the larva and the mature worm. The ova are passed from a segment

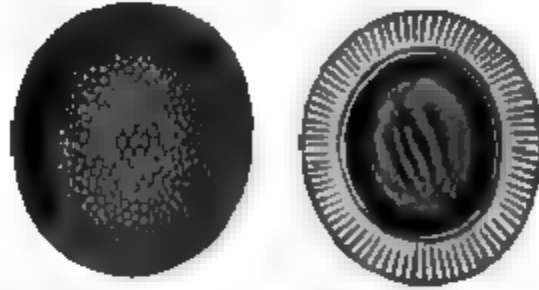


Fig. 56.—Eggs of tenia solium.

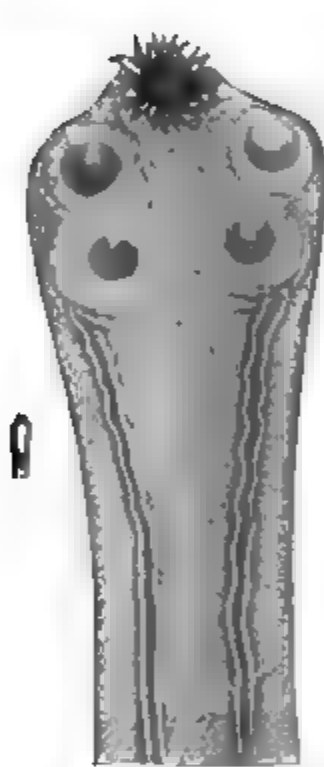


Fig. 57.—Head of tenia solium.
(Magnified eighteen times.)



Fig. 58.—Head of tenia saginata.
(Magnified eleven times.)

of the mature worm, which is found only in man and out with the feces. The egg then passes to the alimentary tract of an animal (the tenia solium in the hog, the tenia saginata in the beef). The egg develops into the larva or embryo which penetrates the intestinal wall by means of its hook-like processes, and becomes encysted in the muscle of the host, there to remain until set at liberty when eaten by man, where it develops in his intestine into the full-developed worm.

The **Tenia Solium** is shorter than the beef worm, measuring from 5 to 15 feet. The segments are shorter and narrower, and the head quite small. It is provided with four suckers, and a number of hooks.

The **Tenia Saginata** or **Mediocanellata** is from 15 to 30 feet long, and consists of segments, thick and yellowish-white in color, about an inch in length. They diminish in size toward the head, which has four suckers upon it.

Symptoms.—These are vague and indeterminate. The diagnosis can in the majority of instances only be made by recognizing the segments in the feces. There may be symptoms of indigestion, restless sleeping at night, perhaps some colicky pains. Alternating constipation and diarrhea may be present, nausea and vomiting may also occur. However, an individual may be a host for years and never suspect the presence of the worm until a segment has passed. There may be more or less anemia.

Treatment.—The use of only inspected meat and meat properly cooked will serve as an efficient prophylactic. Before treatment is begun careful instructions must be given that no passage from the bowel must be had except on a vessel, so it can be closely examined, and the head of the worm found, otherwise it could not be told whether the case was cured.

The child is given a very light supper, and a dose of castor oil. Before breakfast the anthelmintic selected is administered, among which may be mentioned oleoresin of male fern; pomegranate or its alkaloid, pelleterine; kousso, turpentine and pumpkin seed.

The oleoresin of male fern in 15 minim doses in a gelatin capsule if the child can swallow it, otherwise emulsion every hour until four doses are taken. This is followed by a dose of citrate of magnesia in three hours.

Pelleterine, while efficient, is too expensive for ordinary use. The following prescription is suggested by Townsend:

R. Oleoresin aspidii	3i
Tincture quillajæ	f. ̄ss
Syr. aurantii dulcis	f. ̄i
Syr. aurantii q.s. ad	f. ̄vii
M. et Sig. Take in two equal doses.	

Turpentine can be taken in an emulsion.

℞ Ol. terebinthinæ	3iiss
Aq. Menth. pip	℥ss
Mucil. tragacanth qs.	℥ii
M. ft. Emuls.	

Sig. One teaspoonful every three hours, to be followed by one or two doses of castor oil a day, in small amounts.

CHAPTER XIV.

SURGICAL CONDITIONS OF THE INTESTINES.

APPENDICITIS.

Definition.—This is an inflammation of the appendix vermiformis, and under this term, on account of the inability to differentiate cases clinically, is included all varieties of inflammation about the caput coli.

Etiology.—Typical appendicitis is rarely seen in early infancy, and but very rarely under five years of age. At this age and until puberty the appendix being relatively longer than in the adult, and with a larger opening, is more liable to develop inflammatory conditions. This allows freer entrance of fecal matter which remains, and as a result of bacterial invasion and a mild catarrhal inflammation forms the nucleus of an enterolith. The younger the child the more the attack differs from one in an adult.

The direct cause is of bacterial origin, the colon bacillus, the streptococcus and typhoid bacillus being most frequently responsible. The presence of intestinal parasites as an exciting cause should be mentioned. The appendix in children is normally located higher in the abdomen than in adults.

In the child subject to that vague condition called lymphatism, in which there is a tendency to the enlargement of the lymph nodes generally, especially of the tonsils, appendicitis is much more liable to occur. The rapid progress of appendicitis in children has been ascribed to the abundance of lymphoid tissue existing in the child's appendix. It has been suggested that infection by the bacillus of la grippe or pneumonia is often responsible for the lighting up of an acute appendicitis.

Pathology.—Four forms of appendicitis are clinically described: 1, *catarrhal*; 2, *ulcerative*; 3, *gangrenous*; 4, *sclerotic*.

1. *Catarrhal.*—In this form the mucous membrane of the

appendix is swollen, its lumen being almost if not entirely obliterated. The process is usually more severe around an enterolith if one be present. The mucous membrane exfoliates and the cavity is filled with broken-down cells and mucus. The swelling is usually more severe at the intestinal opening. After the subsidence of the catarrhal inflammation the mucous membrane never returns to a normal condition.

2. *Ulcerative*.—This is rarely a primary condition, the ulcerative being grafted on the catarrhal form. The ulcerative process may involve a few small areas or the entire mucous membrane of the appendix. In those cases of the ulcerative form in which there have been two or three attacks, without perforation, and which finally subside and apparently get well, there remains a constricting band of mucous membrane at the site of the most violent ulceration. There may be one spot where the ulceration is more severe which may result in a perforation. The point where this occurs is near the tip, as a rule, though at the site of the enterolith the ulceration may be so severe as to result in a perforation. When a perforation of all the coats of the appendix occurs, it may result in a general peritonitis or the formation of an abscess, walled off from the general cavity.

3. *Gangrenous*.—In this form the inflammation is so violent that a part or the entire appendix sloughs off, causing a general peritonitis or a localized abscess, as in the perforative or ulcerative form.

4. *Sclerotic*.—This results from a chronic inflammatory process involving a portion or the entire organ. As the inflammation subsides there is at its site a formation of new connective tissue which strangulates the normal structure, resulting in a replacement by fibrous tissue.

In all forms but the last there may be a mild localized peritonitis with the formation of small, fine cobweb adhesions. In the latter these adhesions may be present as a result of the pre-existing acute process. In the perforative form, without a localizing inflammatory wall, a large quantity of pus rapidly forms in the cavity. This is usually thin and yellowish, and contains large flakes of plastic lymph or fibrin.

Symptoms.—1. *Catarrhal*. In this form there is pain referred to the right side of the abdomen, more frequently in the right iliac region, but owing to the long mesoappendix in children it may be nearer the umbilicus, and not infrequently in the hypogastric region over the bladder, the epigastrium, or at any point from the liver to the iliac fossa. No dependence can be placed on the statement of the child regarding abdominal pain in appendicitis. This is associated with tenderness over the site of the appendix, and quite early there develops a rigidity of the rectus muscle over the affected side, this guard being an involuntary manifestation. Rigidity must be differentiated from voluntary spasm. It is less apt to be present in the catarrhal form to any great extent, but is always present in the other more severe forms. There is a slight rise of temperature to 100° or 101° F., with quickened pulse and respiration, and *vomiting* may be a prominent symptom. Diarrhea or constipation may be present, more often the former. Painful micturition may also be present. These symptoms may be so slight as to almost escape notice and go entirely unrecognized, being of short duration and not severe, and perhaps mistaken for an ordinary attack of colic.

This was the case in an institution child, nine years old, under my observation, who had been ill for a few days with an abscess at the root of a tooth, relieved by extraction. The temperature had been normal for two days when there was a rise to 102 $\frac{3}{5}$ ° F. I was again called, and the closest questioning did not elicit any complaint or history which would aid in the diagnosis. No complaint had been made to the infirmiry nurse. A thorough examination was then made, the chest was negative, and on palpation of the abdomen a distinct mass the size of an egg was found in the right iliac region, and an appendiceal abscess diagnosed. This was concurred in by the surgeon, and the child operated upon within four hours. An abscess was found containing fully 3 ounces of fetid pus, and with great difficulty a perforated and gangrenous appendix was freed from the dense adhesions.

This case is illustrative of the class, and also emphasizes that institution children cannot be taken as a guide as they are usually stoical and complain much less than children in private families.

Attacks usually recur with comparative frequency, each one likely to be more severe than the former. When there is a history of frequent preceding attacks, careful palpation may reveal

the congested and swollen appendix through the thin abdominal wall.

2. The *ulcerative* form, as a rule, presents more acute and active symptoms, an exaggeration of those of the catarrhal type. The pain is more severe, the patient seems sicker from the onset, the temperature may reach 103° F., vomiting is recurrent, great pain being caused by the retching; the tenderness is located over the appendix, usually at a point midway between the umbilicus and the anterior superior spine, the so-called McBurney point. The bowels are more often constipated than loose, though a diarrhea may be present.

This is the description of a classic case, but there are frequent anomalies encountered. Because of the atypical cases the diagnosis, sometimes, is most difficult, and again practically no symptoms are present calling attention to the abdomen until a general perforative peritonitis has developed and the child is dangerously sick.

3. In the *perforative* form with localization of the abscess there is an easily palpable tumor, rigidity of the right rectus muscle, high temperature, characteristic attitude, lying upon the back with legs drawn up; hurried, shallow respiration, and rapidly forming and sometimes severe tympanites. The face has an anxious expression, and the pulse is small and rapid. There may be sweats.

The blood count will show a marked leucocytosis and this may be a decided diagnostic aid. If there is a count of 18,000 or more leucocytes the diagnosis is usually more certain. A steadily-increasing leucocytosis is a more typical picture and a worse sign than a single examination in which a large increase is found.

Cabot states that mildest and severest cases show no leucocytosis. Catarrhal appendicitis is rarely accompanied by leucocytosis. A low count (8,000 to 11,000) means a mild case, a very severe case or an abscess thoroughly walled off. When a leucocytosis of 18,000 to 25,000 is maintained for a number of days, it usually means a large abscess pretty well walled off. Bloodgood considers that "within the first 48 hours a leucocytosis of 18,000 should be considered an indication for

operation, especially if there is a rising leucocyte count." A persistent low leucocyte count is generally a positive indication for operative interference when taken into account with the other clinical signs.

The symptoms of the gangrenous form are practically those of the ulcerative type, except they are apt to be quicker in developing.

4. *Sclerotic* appendices present most constant pain, nagging in character and are accompanied by more or less digestive disturbance. Palpation reveals tenderness and slight rigidity.

Diagnosis.—This, as a rule, is not very difficult, but has to be made from a *pneumonia*, *pleurisy*, especially of the lower portion, and of the diaphragmatic layer, *intussusception* and *volvulus*.

The most frequent mistake in diagnosis would be in mistaking an acute appendicitis of mild type for an acute *indigestion* or *colic*.

In right-sided *pneumonia* the characteristic expiratory grunt is present, dilation of the *alæ nasi*, redness of the cheek of the affected side, and the characteristic physical signs, as well as a much-quicken pulse and respiration in the typical ratio of pneumonia, and higher temperature. It must be borne in mind, however, that in some cases of central pneumonia there may be few of the typical pneumonia symptoms present. Cough may be wholly absent. Morse¹ stated that "the abdomen has been twice opened in children by well-known Boston surgeons for appendicitis, when the trouble was lobar pneumonia."

Examination of the chest should be made in every case of suspected appendicitis in a child, and in cases of grave doubt, wait until developments clear up the diagnosis.

In a diaphragmatic *pleurisy* there may be more difficulty in making a diagnosis as the physical signs of pleurisy are masked, the pain is apt to be referred downward, and there may be slight rigidity of the right rectus muscle. The restricted freedom of movement of the chest is one of the chief signs.

In *intussusception* the early presence of the tumor, which is movable, the associated vomiting, of stercoraceous type if obstruction is complete; the passage of bloody mucus, and without

¹ American Gynecology and Pediatrics, vol. 13, p. 143, 1900.

much fever, is sufficient to make the diagnosis of this condition. The tumor of an intussusception may be felt by a rectal examination.

Prognosis.—Even if of a mild catarrhal type attacks are apt to be recurrent. Age is an important factor. The prognosis is graver the younger the child and the more severe the type encountered. In the acute perforative and gangrenous type it is especially bad and a guarded prognosis should be given in every case.

Treatment.—In no case of appendicitis should the pediatricist conduct the case without the advice of a surgeon who, in justice to all concerned, should be called early. The disease is essentially a surgical one, and in the majority of cases an operation is indicated.

If appendicitis is even suspected, the child must be put to bed, put on a starvation diet for a few hours, and an ice bag applied to the abdomen. An enema should be given promptly. Opiates should not be given as they mask the symptoms and render later and more positive diagnosis difficult.

If the ulcerative type can be diagnosed, an operation should be performed early. Kelly gives the following reasons for the early operation, during the first 24 hours: “It is safest, the operation is more easily done, the patient is spared days of suffering; the liability to recurrent attacks and the risk of hernia are obviated.”

Richardson¹ states “that the appendix should be removed in (1), all severe cases seen early, unless there are contraindications to operation in other organs or in the patient’s general condition; (2), in all severe cases which when first seen are at a standstill or are increasing in severity; (3), in all cases in which the symptoms are well marked and well localized; (4), in all severe cases unless they are unmistakably improving; (5), in those cases in which the disease is limited to the appendix itself, and it is presumably certain the abdomen can be closed without drainage.”

If more than 24 hours has elapsed since the initial symptoms the operation had perhaps best be postponed until later.

¹ Park’s Surgery.

The interval operation is indicated in recurrent cases, the mortality in these being nil.

The *operation* in a child is usually easier than in an adult. The muscles are thinner in the abdominal wall and anesthesia relaxation easier produced. The operation should always be quickly performed, as the time element in the production of the shock is very great. Because of the need of stimulation, ether is the best anesthetic to be used. Care in its administration is more necessary than in adults.

Because of the various locations of the appendix in the child, no special incision can be selected for all cases; it should be made long enough primarily in order not to be obliged to lose time by enlarging it later. Some discretion is necessary in deciding whether to drain, to prolong the operation looking for the appendix in gangrenous cases, etc.

Postoperative temperature is the rule for a day or two. To combat the thirst, saline enemata every four hours should be given in amounts which it is found the child will retain, and water by the mouth as soon as there is no nausea. Liquid nourishment is given early.

Opium can be given for great pain and restlessness. Bromides may be used in the less severe cases.

INTUSSUSCEPTION.

This condition is an obstruction of the bowel due to the slipping of one segment of the bowel into another. When one sees the large number of postmortem intussusceptions in one case, it is a wonder it is not more often encountered in the living. Frequently as much as 10 or 15 inches of the small gut will be found invaginated at the autopsy, there being often a number of these, and the invaginations are easily reduced.

Pathology.—The invagination is from above downward, in the direction of the fecal current. There are three layers of bowel at the tumor, the outer, invaginating, covering or receiving layer is the *intussuscipiens*, the inner layer the *intussusceptum*. The narrow, constricted end is the neck. The neck is very frequently the ileocecal valve, and several feet of the ileum may pass through the neck into the colon.

Etiology.—Two theories of the cause have been presented, the theory of spasm and of paralysis.

Wallace¹ suggests that a portion of the bowel is damaged by some interference with its blood supply and bulges and may perforate, and that the intussusception is the result of nature's effort to reinforce the weak piece by splinting it between healthy layers of intestinal wall, and that instead of being the cause of the trouble the invagination supports the weakened intestine.

It is more apt to occur during an attack of acute intestinal disorders when peristalsis is most active. The relatively long mesentery of the bowel in infancy and the thinness of the bowel wall has been given as a cause. It is rarely seen in early infancy, being most frequent from the sixth month to the second year, and quite rarely after this period. In a large percentage of cases the invagination occurs at the ileocecal valve, the small intestine slipping into the colon, the large intestine literally swallowing the small, though many occur in the small intestine. It occurs more often in boys, in the ratio of about two to one.

Quite rarely the reverse of the above is seen, where the intussusception will be a segment of bowel from below, telescoping into the intussusciens above. If much of the bowel is invaginated owing to the mesentery being attached, the tumor is curved on itself, because the mesentery attached to the bowel is pulled in after it.

Owing to the constriction at the neck and engorgement of the intussusceptum, pathological changes occur quickly, but the extent of these depend upon the length of time which the condition has existed. If it has existed for some time reduction may be impossible, both from the adhesions formed and the greater engorgement of the apex of the intussusception. Only one thing can occur, if enough time elapses, viz., sloughing of the intussusceptum at its most constricted portion. Adhesions form between the invaginated layers, and as inflammation of the peritoneum progresses adhesions of coils of the bowels may occur externally.

Symptoms.—The onset is usually sudden, and if much of the bowel is invaginated and sudden constriction occurs, the onset

¹ Journal American Medical Association, April 11, 1908.

may be associated with some shock. *Pain* is a prominent symptom, sudden and violent. The child cries out, draws up its legs and *vomiting* shortly begins. Distension of the abdomen is soon noted and the child will soon pass blood and mucus from the rectum. The first evacuation may be fecal, but it is soon followed by blood and mucus. This is one of the characteristic symptoms. There is usually no fever at the onset, in fact the temperature may be subnormal, and its elevation indicates beginning peritonitis, but the respiration and pulse, especially the latter, are accelerated. If obstruction is complete the vomiting may soon become stercoraceous in character, usually not occurring, however, until late. Later, as peritonitis develops there is a rise of several degrees in the temperature.

The child has an anxious expression, in fact looks sick. The presence of a tumor in the abdomen is convincing proof of the condition. Through the thin abdominal wall of the child this can usually be found, unless the tympany has been too rapid in forming. As the intussusception is so often found at the ileocecal valve, the tumor is most often to be found on the right side of the abdomen between the right iliac region and the right hypochondrium. The tumor is doughy to the touch, is sausage-shaped and rounded. The child may be so sensitive as to make palpation of the abdomen impossible. In many cases the tumor or intussusception can be felt through the rectum, especially if the invagination is in the sigmoid. Hiccough may be present and is an unfavorable sign.

The *duration* of the attack varies greatly. The attack may be so acute as to be fatal in 24 hours, unless the diagnosis is made early and the condition relieved. Other cases may run on for four or five days, and one unusual case has been reported by Snow¹ of Buffalo in which a seven-months'-old child suffered from an intussusception for 16 days, when a piece of gangrenous intestine 6 inches in length protruded from the rectum, was ligated and removed, recovery following.

Diagnosis.—The chief diagnostic points are the sudden onset, great pain, acute obstruction of the bowel, bloody-mucous evacuations, the presence of the tumor in the abdomen, absence of

¹ Carr: *Practice of Pediatrics*.

fever at the beginning, the continuous vomiting and the tympany.

There is a train of symptoms not seen in any other condition, but even with the association of a few of them, an intussusception should be suspected, and in a child this suspicion becomes verified if a sausage tumor is felt in the belly or the invaginated gut palpated per rectum.

Prognosis.—This is necessarily grave, the mortality being over 60 per cent in a number of cases reported by different observers. Prompt operative interference offers good results. Temporizing by trying this or that mechanical means of reduction renders the prognosis less favorable, if operation is finally resorted to. Chronic cases, because of adhesions, render the operation very difficult.

Spontaneous cures by sloughing off of the intussusception have been recorded but they are rare, and cases should never be neglected by waiting for this result.

Treatment.—The only safe and satisfactory method of treatment is surgical; a laparotomy and reduction of the intussusception by slipping out the invaginated portion of the gut. The earlier this is done the more satisfactory the results. The longer the operation is delayed the more dangerous it becomes and the more difficult the reduction because of the adhesions formed between the layers of the gut. Reduction may be impossible, rendering resection of the bowel imperative. This is necessarily a very serious operation in an infant.

Owing to the tendency for the invagination to recur at the same site after reduction, the mesentery should be shortened at the time of operation. Chloroform should be the anesthetic of choice during operation.

Palliative methods of treatment offer less than the operative, promising practically nothing. The ones recommended are the inflation of the bowel by gas, and the injection of water, the patient being inverted during both of these treatments. *I do not think they should be used under any conditions.*

The injection of air can be accomplished through a large catheter or rectal tube by a bicycle or automobile tire pump, great care and gentleness being exercised. If water is used it

can be injected through the same catheter or tube, the fountain syringe being held 4 or 5 feet above the patient, and 3 or 4 quarts of water used at an injection. The hand should be held upon the tumor during this treatment so that the reduction of the intussusception can be ascertained.

If reduction is perchance accomplished, the child must not be fed for 8 or 10 hours, kept in partly-inverted position, and under the influence of an opiate for at least two days.

CHAPTER XV.

GENERAL DISEASES.

TYPHOID FEVER.

Synonym.—*Enteric fever.*

Definition.—An acute, infectious, febrile disease due to the entrance into the body of the bacillus of Eberth.

Etiology.—The disease is due to the bacillus of Eberth, which is taken in the body through the stomach, in food or drink, usually either water or milk. Infected dishes or spoons may convey the bacillus, or the hands contaminated by the discharges from the bowel or kidneys of a patient with typhoid may carry them to the mouth.

In 638 epidemics of typhoid fever 17 per cent were due to contaminated milk, as reported in "Milk in Its Relation to Public Health." This reports 138 epidemics traceable to a specific pollution of the milk.

The number of cases of typhoid fever occurring in the camps during the Spanish-American War called attention to the fly as a disseminator of the contagion in a very practical and serious manner. Levy believes the bacilli can enter the body through dust. The "typhoid carrier," an individual who apparently well, harbors virulent typhoid bacilli, may cause many cases.

Age.—The infrequency of typhoid in infancy is due to the number of breast-fed infants; when put on artificial food the chance of contagion is greater. I have seen one case of typhoid develop in a breast-fed infant six months old, who was weaned because of typhoid in the mother; the attack in the infant beginning in the third week of the mother's illness.

Dividing the first 15 years into equal parts the far greater number of cases of typhoid occur during the last period, the least during the first, though it is not infrequent after the second year.

In this section of the country, and along the valleys, it occurs

more frequently during the late summer and fall months. A prevalence of typhoid is always expected following the first rains after a prolonged drouth where the water supply is not filtered or boiled.

Bacteriology.—Eberth first described the bacillus of typhoid fever in 1880. It is a small, short organism with rounded ends and very motile, with numerous flagelli, the latter being stained by Loeffler's method. It is both saprophytic and parasitic. They grow at room temperature, and are killed at 60° C. They are very hardy, cold does not affect them, and they live from 7 to 10 weeks on articles of clothing or other objects. They grow readily and characteristically upon acid potato, bouillon and milk.

They are thrown off from the body in the discharge from the bowel and kidneys, both of which may cause a dissemination of the disease.

Pathology.—The bacilli gain entrance to the body through the mouth, and because of their resistant nature are not harmed by the acid juices of the stomach, passing into the intestine, and find lodgement in the agminated glands or Peyer's patches. The bacilli propagate in these glands, and as a result there is an increase in the number of cells, the gland undergoing a regular pathologic change, swelling, necrosis, ulceration and cicatrization. From the Peyer's patches the bacilli enter the lymphatic and general blood circulation, and are found early in the disease in the mesenteric glands, spleen and blood current, the kidneys and skin.

Autopsy findings in the very young differ some from those in older children, in that the ulceration is not so great in infancy. The process in older children is similar to that in adults.

There is decided enlargement and some softening of the mesenteric lymph glands, and an enlargement of the spleen. The spleen can practically always be palpated in typhoid, as it is quite perceptibly softened and enlarged. The kidneys usually show cloudy swelling.

Symptoms.—My experience has been to find that, as a rule, typhoid fever in children is milder, of shorter duration and fewer complications than in adults.

Period of Incubation.—The onset is usually gradual, though it is not at all infrequent for the attack to be explosive in its onset, with vomiting and fever, the child being apparently entirely well previously. During the period of incubation it is apt to be droopy, not inclined to play or be amused; if old enough complains of headache and loss of appetite. There may be a slight rise of temperature at this time, but it is usually not taken until the child is believed to be sick. Not infrequently there seems to be an overwhelming of the nervous system by the toxins, the symptoms at first resembling meningitis.

Period of Fever.—The typical fever curve of the adult type of typhoid is not always seen in children, especially those cases of the explosive type or which begin with a chill. In these the temperature is high from the onset. The temperature may be found to rise gradually, with morning remissions and evening rise, each day, both the morning and evening record, being higher than the previous day, until the second week, when the temperature rises to about the same line each afternoon, with a degree or two morning remission. The maximum evening temperature is usually not much over 104° F., though it may go higher.

During the third week there is a gradual fall, the morning temperature not infrequently reaching normal by the eighteenth day. The division of these fever periods into weeks is an entirely arbitrary one, representing more the stages, the rise, the continuously high fever, and the drop by lysis, than division into the seven days constituting a week.

Hyperpyrexia is infrequent. A sudden drop in the temperature to normal or below is alarming, pointing usually to a hemorrhage from a Pyer's patch.

The *pulse* increases in frequency as the fever rises, but is usually faster than would be expected. As the temperature falls during the third week, the pulse is apt to be dicrotic.

The *tongue* does not show as marked change as in the adult. It is coated from the beginning but rarely is as dry as in adult typhoid. The coat becomes more marked in the center and the edges red. The mouth is dry and often ulcerated.

The *stomach* in the beginning may be upset. Early vomiting

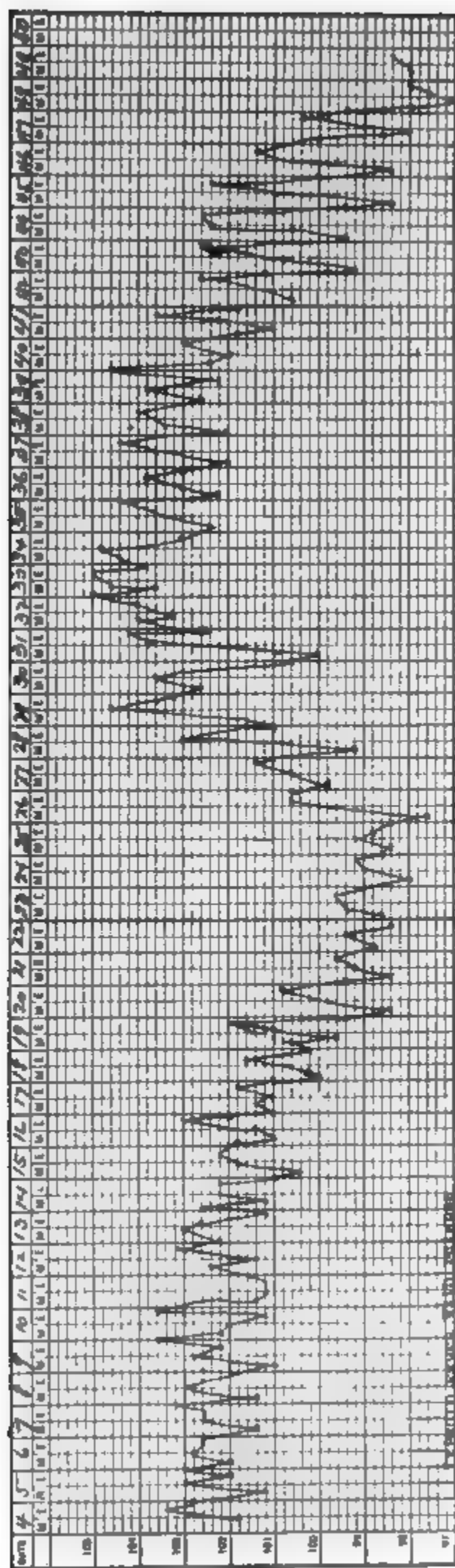


Fig. 59.—Typhoid fever with reinfection. Child two years old.

is not infrequent, but later is exceptional. The *bowels* are distended after the first week. *Tympanites* is not marked until the second or third week. There may be diarrhea, but constipation is very often present. If diarrhea is present "pea-soup" discharges are the rule. It is very frequent that enemas must be given regularly to obtain evacuations. *Nosebleed* occurs less frequently in children.

The *eruption* of the rose-colored spots appears early in the second week, and is seen in practically all cases. They are generally on the skin of the abdomen, though they may be found on any part of the body. These spots are small, papular, slightly raised and disappear on pressure. I have never failed to find them when they were looked for carefully.

Headache is not a prominent symptom after the first week, though restlessness may be a feature after this time. The headache at first is often very severe and suggestive of meningitis. *Stupor* and *delirium* are frequently seen in children, the latter being of the low, muttering type, with picking at the bed clothes or imaginary objects frequent.

There is a reduction in the number of both the red and white *blood cells*, the reduction being much greater after a hemorrhage. There is a coincident decrease in the hemoglobin. The *Widal reaction* is present early in the second week. This is a typical reaction and is due to the production of a substance in the blood, which when added to a solution containing active typhoid bacilli causes them to cease moving and to form in clumps. The *urine* is diminished in quantity, and during the height of the fever high-colored and of high specific gravity. The toxicity of the urine is increased. When the kidneys are invaded by the bacilli, an inflammatory process is set up, manifested by albumin, hyaline and granular casts. This is a complication and not seen in every case.

The *diazo reaction* is present in a large percentage of cases, and somewhat earlier than the Widal test—probably as early as the last of the first week.

In inflammatory conditions of the kidney due to the presence of the bacilli, the organisms can be found in the urine.

The *lymph nodes* are enlarged and can be palpated in the

neck, axilla and groin, though they do not reach the size of the nodes in the other infectious diseases. The spleen is palpable throughout most of the attack.

Complications.—*Hemorrhage* is seen less often in children than adults. It occurs usually at the end of the second or beginning of the third week. I have observed hemorrhages but twice

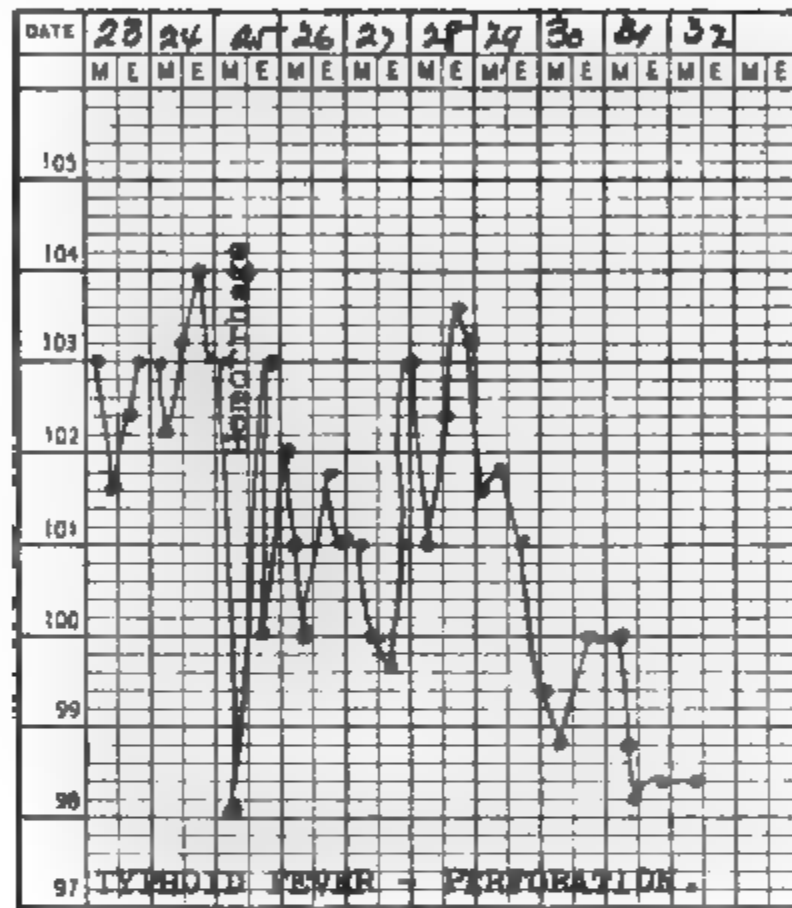


Fig 60. —Typhoid fever; hemorrhage; perforation.

in children. A hemorrhage is very regularly followed by a drop in the temperature of from 3° to 5° F., a corresponding increase in the pulse rate and acute anemia and prostration.

Perforation occurs more often in the hemorrhagic cases. Its occurrence is associated with sudden and acute pain, and probably some rigidity of the abdomen, but there are no other decided symptoms which are always present. Peritonitis follows a perforation in a short time, shock is usually present, and a fatal termination prompt. In the only case which has come under my observation the following history presented:

Boy, aged 13, irregular temperature for one week, continuously between 101° and 103° F. after the sixth day; first spots noted on the twelfth

and thirteenth days. Active delirium from the seventeenth day, with great restlessness; nosebleed on twenty-second day, with hemorrhage from the bowel on the twenty-third day, and a very large intestinal hemorrhage on the twenty-fourth day. Temperature chart from the twenty-third day until death is given. Twenty-sixth day the pulse was 130 and very weak; twenty-seventh, vomits nourishment; thirtieth day, rational at times and complains constantly of pain in his abdomen; thirty-first day completely deaf; death on the thirty-second day of his illness. *Postmortem* showed general peritonitis, fluid in pelvis, bowel covered with thick layers of plastic lymph; one perforation, punched out in appearance, one-fourth inch in diameter, about 10 inches from the cecum; no adhesions about perforation.

Bronchitis is a frequent complication and a bronchopneumonia not uncommon. The occurrence of a rapid respiration, slightly higher temperature and cough is sufficient to cause the respiratory organs to be suspected. The *bronchopneumonia* is hypostatic in character and occurs as a late complication, while bronchitis is seen earlier.

Chorea may develop late in the attack or during convalescence. Reports of *melancholia* and *mania* have been made as complications of typhoid fever.

Otitis media, due to the direct infection of the middle ear by the bacillus, occurs in a small percentage of cases. It is usually mild, and tends to recovery without complications.

Aphasia is an infrequent complication, but a very striking one. The following case is illustrative:

Lucile M., aged five and a half years, the only child of a young mother. She was spoiled and petted, and was taken rather suddenly ill the first week in January, 1906. Typhoid fever was early suspected by the attending physician, but the diagnosis was not confirmed until January 8, when the rose spots were first discovered. It was entirely impossible for the child to be controlled at the home of her parents, and she was removed to the residence of a relative of whom she was very fond. Every member of the family was ostracised, and the child put in the entire charge of a day and a night nurse.

It is difficult to adequately convey the impression of the kind of patient we had to deal with in this little girl. She was wilful, peevish, petulant, cross, defiant and extremely difficult to control. From the temperature chart exhibited it can be seen that the course of her attack was moderately severe. The maximum temperature was 105° F., reached on the thirteenth and fourteenth of January, the seventh and eighth days of her attack. The impression of the toxins on the central nervous system was quite profound,

there being delirium, involuntary passages from both bowel and bladder, and muttering talk. On the seventeenth day there was difficulty in swallowing, but this was of only two or three days' duration.

Three or four days after the temperature reached normal the child was noticed to mumble its words, where her speech previously had been all right. She did not articulate plainly enough to be understood. She was asked if she wanted a drink of water and seemed frightened when she could not reply. From this time for three weeks she did not utter a sound. At the end of this time she was heard to make a sound; in a few minutes she mumbled unintelligible words, much as she had done at the beginning of the attack. For two or three days this mumbling continued and by the end of the week she was talking plainly. She did not have to be taught words or their meaning. As soon as she began to articulate she had no difficulty in the least in framing sentences.

Her convalescence from this time was uneventful and rapid. During the next winter she attended school for the first time, however, being kept out of her class on account of whooping cough and measles for a good portion of the time, yet she was promoted to the next grade.

Furunculosis is often observed in children. Inflammatory *joint* lesions occur during the latter part of the disease or during convalescence, and occasionally bony changes, abscess of the bones being the most frequent form of trouble.

Diagnosis.—Diagnosis must be made chiefly from tuberculosis, malaria, gastrointestinal infection, pyelitis, meningitis, sepsis, appendicitis. Among the chief diagnostic points may be mentioned the fairly typical *temperature*, *enlarged spleen*, *rose-colored spots* and the laboratory methods of diagnosis; Ehrlich's *diazo reaction* and the *Widal test*. The diazo reaction is obtained as follows: Two solutions are prepared, (1) a saturated solution of sulphanilic acid in 1000 cc. of water and 50 cc. hydrochloric acid; (2) a 0.5 per cent solution of sodium nitrite. To 10 cc. of the sulphanilic acid solution in a test tube are added 4 drops of the sodium nitrite solution and 10 cc. of the suspected urine. These are well shaken, and a layer of ammonia floated on the surface. A bright-red ring at the point of contact of the two solutions appears if the urine is from a typhoid case. A deep-red color should also appear in the fluid and the foam when the solution is well shaken.

The Widal test¹ is made as follows:

A drop of fresh or dried blood from the ear of the patient is

¹ French: Practice of Medicine.

diluted with 5, 10 and 25 or more times as much saline solution. A drop of fresh, virulent bouillon culture of typhoid bacilli is then added to each, thus forming dilutions of 1:10, 1:20 and 1:50, respectively. The specimens are immediately examined under the microscope in the hanging drop. The typhoid culture should be from 18 to 24 hours old and made from a stock culture that is known to react readily to the serum test. It should be examined in the hanging drop before the serum has been added in order to see that it is free from clumping. If the bacilli are very numerous, the culture may be diluted with salt solution. The agglutination may occur immediately or after 10 or 15 minutes. The bacilli appear grouped together in irregular tufts of variable size and become motionless. The time at which the reaction becomes distinct in the different dilutions should be recorded. In the dilution of 1:10 an immediate agglutination generally takes place. It may occur in a dilution of 1:50, 1:100, or even higher. A specially devised agglutinometer for making the test without the use of living cultures or the microscope may be employed.

The absence of this reaction throughout a disease may be regarded as positive evidence that typhoid fever is not present, since it has been found in 97.9 per cent of 4897 cases collected by Brill.

An agglutination of the typhoid bacillus has been obtained from the blood of patients suffering with malaria, typhus, miliary tuberculosis, cerebrospinal meningitis, and other acute infections, but rarely in a higher dilution than 1:5. A reaction obtained from a dilution of 1:30 is, therefore, a positive demonstration of typhoid fever in nearly all cases, unless the patient has previously passed through the disease, for the blood often continues to agglutinate the bacilli for many years after recovery. About half the cases do not give a positive reaction before the beginning of the second week, and about a third of the cases do not give a reaction before the early part of the third week. It may appear, on the other hand, as early as the fourth or fifth day. Rarely, it is first obtained in a relapse.

Tuberculosis. There may be some difficulty in differentiating this disease from typhoid, and the laboratory aids to diagnosis

may have to be called upon to clear it up. The occurrence of a previous pneumonia, pertussis, prolonged bronchitis, emaciation, etc., is more common in tuberculosis. In tubercular meningitis the mental symptoms are prominent early and become gradually more profound, while in typhoid the meningeal symptoms appear early.

Malaria in the South may be mistaken for typhoid. The presence of the plasmodium in the blood and the response of the condition to quinine are diagnostic points of value.

Gastrointestinal infection may present symptoms which are confusing. Usually the temperature curve is not so high or long and the intestinal symptoms are more marked.

Pyelitis is very apt to be confused. In one of my cases of pyelitis, because of the inability to obtain a sample of urine for some days, typhoid was strongly suspected, but the diagnosis was cleared up as soon as a microscopic examination was made of the urine.

Septic conditions, such as arise in Pott's disease of the spine with abscess formation, abscess of the liver, and other deep-seated abscesses may be confusing at first.

Close observation and inspection of the abdomen should make the differentiation between *appendicitis* and typhoid easy. The rigidity of the abdomen and tumor with abscess formation is quite typical of appendicitis.

Prognosis.—In uncomplicated cases the prognosis is good. The younger the child the more grave the prognosis. Hemorrhagic cases are more often fatal. Griffiths reports a mortality of 3 per cent, Abt reports a mortality of 2.9 per cent. Perforation is always fatal without operation. The course is milder in children and the duration shorter as a rule.

Treatment. Prophylaxis.—Proper care and disinfection of the evacuations and urine of typhoid fever patients would greatly lessen the number of cases which are annually seen. In the country, wells and cisterns should be carefully protected from sewerage and drainage from the house, and removed from the outhouses and privies. In cities, unless the city water supply is filtered, all water which is given the children should be carefully boiled. Only a certified milk should be used where it is

obtainable. If a market milk is used the dairy from which it comes should be visited and the methods of the dairyman learned. Frequent inquiry should be made as to the presence of illness on this place, and if these conditions are unsatisfactory the milk should be Pasteurized or sterilized before being used.

If a case of typhoid occurs in a private family careful and explicit directions must be given to other members of the family. Crude carbolic acid should be added to the feces before it is emptied, and all vessels and utensils used by the patient should be used by him exclusively and boiled each day.

A tub containing a 1:3000 bichloride of mercury solution or a 1:20 carbolic acid solution should be provided, in which the bed linen is soaked before it is washed. It should not be washed with the other household linen. Squares of soft cloth or gauze should be used instead of handkerchiefs, and these burned when soiled.

Management.—The presence of fever from any cause in a child is an indication for it to be kept in bed, but especially so when typhoid fever is suspected. The best room in the house should be chosen, with bath room and toilet conveniences nearby. No matter how young the child it can be kept in bed, and if it is put in charge of a nurse who is gentle, yet firm, this can be accomplished. It is rare that the youngest patient has to be taken up and held. Its position should be frequently changed, not allowing it to lie long in any position. It should not be allowed to get up to the vessel, but should be taught to use the bed pan. No company should be allowed, no one in the room but the nurse and mother.

A bedside record is an essential in the conduct of a typhoid, and a temperature chart or tracing just as important. In no other way can the run of the fever of a typhoid be so accurately kept track of as by the use of the temperature chart. Temperature, pulse and respiration should be taken every four hours.

The child's eyes should be protected from the direct light, but the room should be bright and airy, the temperature not more than 65° or 70° F. The bed should be comfortable, pushed away from the wall so as to be approached from all sides, with

a firm, but not too hard mattress. The mattress should be protected by a rubber sheet, but plenty of thicknesses of sheets or pads to protect the skin, otherwise a sudamina or heat rash will be caused from the rubber sheet. The gown and sheet should be kept free from wrinkles at all times.

A daily general soap and water cleansing bath should be given, as nothing so adds to the comfort of the child. This should be given irrespective of the baths given for temperature. The judicious application of a 50 per cent solution of alcohol to the hips and back will prevent bed sores developing.

The mouth and teeth should be carefully watched and washed at frequent intervals. A very pleasant mouth wash is the following:

R. Glycerine	℥iss
Listerine	℥ss
Lemon juice	℥ss
M. ft. Mouth wash.	

The mouth should be rinsed after every feeding and the mouth wash used in the interval.

Diet.—No other phase of the management of typhoid is so important and so difficult to control as the feeding of the patient. Milk as an exclusive diet in typhoid is not well borne. It offers an excellent culture medium for the organisms which are found in the intestine with the typhoid bacillus. The same objection obtains in the exclusive use of the animal broths also, as they do not meet the demands of the nutrition. If milk is well borne it should be well diluted, with a *low* fat percentage. Frequently a fat-free buttermilk is well borne and relished. It may be necessary to peptonize the milk if there are evidences that the proteids are causing an irritation. If a diarrhea begins, the milk should be withdrawn. Dr. F. W. Werner of Joliet, Ill., recommends strongly the exclusive use of hot, weak tea, claiming for the tea that it is bactericidal, and the fluid and slightly stimulating effect of the tea are beneficial.

Food should be liquid and given at regular intervals, and in less quantity than in health. Three to four ounces every four hours during the day and twice during the night is ample, with a liberal amount of water between.

Cereal decoctions, dextrinized, are well borne, and usually taken with a relish. They can be flavored with the broths, beef juice or with sherry, if not otherwise well taken.

The caloric method of feeding in typhoid is attracting much attention, emphasis being laid on the carbohydrates to increase the nutritive value of the food.

Stimulation.—Stimulants should never be given as routine, but reserved until they are absolutely indicated, as they frequently are late in the attack. When the heart beat is weak and flagging or dicrotic, alcohol is of decided benefit, especially when the second sound of the heart is muffled or weak. Only the best bottled-in-bond article of whisky or equally good brandy should be selected. Children stand whisky well and respond to its effects quickly. A half to one teaspoonful well diluted can be given to a child of one year for its effect, every three or four hours. Digitalis (2 to 5 min.), strophanthus (2 min.), both in the form of the tincture; sulphate of strychnine ($1/200$ gr.) by the mouth or hypodermically to a child of two years, or nitroglycerine ($1/500$ gr.) in emergencies.

Fever.—A temperature below 103° F. does not need any special treatment, but when it rises to 103° F. or over it should be reduced. Coal-tar antipyretics should never be given, and resort must be had to hydrotherapy, which can be administered by the sponge, tub or pack. If the child is under two years of age it can be put in the tub without trouble, but a tub bath is difficult to give to older children without extra assistance. Lowering the child into the water on a sheet stretched across the tub will often be of great assistance. The water should be warm, 85° or 90° F., and cooled from 5° to 8° by adding cool water at the foot of the tub and thoroughly mixing. The bath is prolonged for 10 minutes, or a shorter time if there is shock or much nervousness and crying. The constant gentle friction of the legs, arms and body, avoiding the abdomen, will make the bath much more efficient, and a drop of 2° or 3° generally results. The application during the bath of a cold, wet compress to the child's head is of assistance.

The sponge bath is often equally as efficient as the tub bath. The child is placed between blankets, and first one member and

then another is exposed and bathed with a piece of gauze thoroughly wet, but not dripping, in water of 85° or 90° F., with long, slow strokes; then the back, first gently turning patient on the side, and lastly the abdomen and chest. The whole process should occupy from 20 to 30 minutes. The pack applied according to Kerley is very efficient. The jacket or pack, long enough to reach below the knees, with arm holes, is put on the child dry, and with a large sponge the water, at 90° F., is mopped on the pack until it is thoroughly wet. As the pack dries, fresh water is applied, gradually cooler, and the pack continued until the temperature is reduced. The temperature of the child should be taken at least half an hour after the bath and finding recorded. The drop, as shown on the temperature chart, should be indicated by an *S*, indicating a sponge, or *B*. for bath.

Bowels.—As a rule constipation is present during typhoid, and much more to be desired than diarrhea. The place which intestinal antiseptics occupy in the treatment of typhoid fever is a moot one. Personally I never employ them, and my results have been as good as my confrères who use them. Enemata of saline solution is usually all that is needed to obtain an action from the bowels, and they should be given regularly. An occasional dose of castor oil is of great benefit or small dose of cascara, 20 or 30 drops, of any of the aromatic preparations.

What constitutes a diarrhea is a matter of individual opinion. More than three movements, if thin, should be considered abnormal and call for treatment. If thin and containing undigested food, a preliminary dose of castor oil should be given, followed, when it has acted, with bismuth subnitrate (gr. x or gr. xv every three hours). Morphia is rarely indicated, but may be needed in very small doses.

Tympanites.—For the dry tongue and tympanites of the third week, no drug can take the place of turpentine, both internally and locally. It is difficult to give internally to a child, either in an emulsion or otherwise, but can be used as a stupe as follows:

R	Ol. terebinthinæ	3i
	Ol. olivæ	3i

M. Sig. Rub one teaspoonful over the entire abdomen, and place over this the hot wet flannel, which should be renewed at half-hour intervals.

The stupes should be watched closely as there is danger of producing strangury if they are kept up too long at a time.

Internally, turpentine can be given in 3 to 5 drop doses in an emulsion flavored with peppermint.

Hemorrhage.—This is the most alarming of any complication which may arise. If the blood passed is black and no perceptible impression has been made upon the pulse, no special active treatment except starvation is required, but if the blood is bright, and there is a coincident fall in the temperature and rise in pulse rate, active measures are indicated at once. The foot of the bed is raised, an ice bag or coil is applied to the abdomen, morphine is given hypodermically (gr. 1/60), and all food and water is withheld in order to stop the peristalsis. Gelatin by the mouth and subcutaneously is of benefit in profuse hemorrhages, and if doubly sterilized, risk from infection from hypodermic use is lessened. Hypodermatic injection of normal horse serum should be tried, also. Feeding is resumed very tentatively.

Convalescence.—This is a most important period, especially as to diet, and the patient must be constantly curbed and watched in order to prevent overdoing and a possible reinfection or relapse. The *diet* should continue the same until the temperature has been normal a week, except more can be given at a time, when the following list can be followed for a child of three years or more:

First Day. To take the place of one liquid feeding, a thick gruel of strained oatmeal.

Second Day. Rice and milk.

Third Day. Boiled custard.

Fourth Day. Milk toast, crust cut off.

Fifth Day. Baked potato, thoroughly mashed.

Sixth Day. Soft-boiled egg, one feeding rice.

Seventh Day. Scraped beef, broiled lightly. During first part of the second week the same articles can be given, only two in one day, and during the latter part more.

RHEUMATISM.

Synonym.—*Rheumatic Fever.*

Etiology.—The specific cause of rheumatic fever or rheumatism has not been located, but the clinical symptoms point to some cause of an acute infectious nature, and the finding of a diplococcus, practically identical, by both Triboulet and Wassermann, is confirmatory of this theory. That it can be due to uric acid or lactic acid does not seem probable.

The association of tonsillitis and pharyngitis with rheumatism, or these conditions being a manifestation of rheumatism, must be borne in mind.

It is infrequent in infants under two years of age; from this to five years the course is very unlike rheumatism in the adult, and may go unrecognized. No joint development may be present. In older children the history is much the same as in adults.

Exposure and fatigue predispose to an attack. Relapses and recurrences are frequent. Heredity must be reckoned with.

Pathology.—All of the serous membranes of the joints and of the heart may be affected. There is a congestion and swelling, with effusion both in the joint and in the surrounding cellular tissue. The frequency of involvement of the endocardium in children is much greater than in adults. The pericardium is not infrequently involved also. The involvement of the heart occurs often when there are but few joints involved, and they but slightly. The changes in the heart may precede the arthritis. The change in the heart is the result of the action of the infective cause of the rheumatism, either bacteria or their toxins, chiefly affecting the membrane lining the valves. The mitral valve is the most frequently involved. As a result of the action of the bacteria, a hyperplasia of the tissue takes place with the formation of vegetations on the valve. This prevents the free closure of the valve, and as a result an obstruction to the flow of the blood current or a regurgitation from imperfect closure.

Symptoms.—These may be so mild as to pass unrecognized.

The child may complain of vague pains in the joints and limbs, which are ordinarily called “growing pains,” but which are not infrequently associated with serious and severe heart lesions. Hence, any joint pain in a child should not be treated lightly.

In typical attacks, of the adult type, there is a chill or rigor, followed by an elevation of temperature from 102° to 105° F. There is languor and lassitude, followed shortly by pain and swelling of the joints. The number of joints affected varies greatly, occasionally only one or two of the large joints are involved, though all may be swollen and tender. One of the large joints, as the knee, and several of the smaller joints may be involved at one time.

It is in those cases with insufficient pain to keep them in bed that the most serious involvement of the heart is seen. The pulse may be irregular and of less volume and a physical examination of the heart reveals the beginning heart lesion. Herz's arm test is a good method of learning the functional capacity of the heart. The elbow is supported by the hand, and with the free hand the wrist of the patient is grasped and the child told to make slow flexion of the forearm. The examiner does not resist this movement. Extension is then made as slowly, the child concentrating his attention to these acts. The pulse is then counted and compared with the count made immediately previous to the test. If the myocardium is not absolutely sound the pulse rate is slowed and the size and strength of the pulse wave lessened. One drop of the tincture of digitalis can be given a child of seven years, and if the myocardium is not normal there will be a difference in the pulse wave and rate from that previous to its ingestion.

Duration.—The acute symptoms usually last from a week to 10 days, though the pain may continue some time longer.

Complications.—Tonsillitis occurs with or may precede by a few days the acute symptoms of rheumatism. In fact a severe attack of tonsillitis may be the only manifestation of rheumatism, and be followed by an endocarditis, hence an attack of tonsillitis or pharyngitis should be regarded with suspicion.

Chorea is closely allied to rheumatism, and may occur during the attack or follow it. Close questioning in cases of chorea will usually bring out a previous history of rheumatism.

Subcutaneous nodules occur in the fibrous or connective tissue of the skin, from the size of a pin head to a small pea, being scattered particularly over the ends of the long bones and the

vertebræ. They may not be visible on superficial inspection, but are easily felt on palpation. They are not painful or tender. No satisfactory explanation has been offered for their appearance. *Heart* changes have been referred to on a previous page.

Various *skin lesions* may appear during an attack of rheumatism. *Sudamina* and *miliaria*, the inflammatory form of sudamina, may develop because of the overactive sweat glands and the acidity of the secretion. *Erythema nodosum* is of rather frequent occurrence. These nodes appear principally upon the anterior surfaces of the tibia, are the size of a bean, discolored usually, and are quite tender on pressure. They may persist after the subsidence of the acute pain. They occur more frequently in females. *Purpura hemorrhagica* may be present, with petechial spots or larger hemorrhagic subcutaneous areas here and there. *Herpes* and *urticaria* are uncommon but do occur. *Peliosis rheumatica*, Schonlein's disease, consists of reddish, raised papules, which are purpuric.

Pulmonary lesions are not uncommon, especially bronchitis and bronchopneumonia. They are probably of septic origin.

The *anemia*, which is always present to a certain extent, may become quite marked, and in the convalescence prove of some moment in the ultimate complete recovery.

Diagnosis.—This is principally from *scorbutus*, *rachitis*, *arthritis*, of *septic*, *gonorrheal* and *tuberculous* origin, and especially in infancy these conditions must be ruled out.

In a large percentage of cases of *scurvy* the first diagnosis made has been rheumatism, and frequently not until the softening of the gums and hemorrhages of the subcutaneous tissue and mucous membrane, that the diagnosis of *scurvy* is made. In *scurvy* without complications there is no fever, which is a prominent symptom of acute rheumatism.

The bony changes in *rachitis*, no fever, head sweats and history should aid the diagnosis.

In *septic arthritis* and *osteomyelitis* the general symptoms and condition of the patient is much more severe than in rheumatism, and the lesion more centered in but one or at the most two joints at a time.

Gonorrhœal arthritis is not frequent in children, but may present symptoms so similar, that without a history of a vaginitis or vulvovaginitis, a diagnosis will not be made until anti-rheumatic agencies fail to relieve symptoms. In *scarlatinal* arthritis the previous history and the presence of desquamation will clear up the diagnosis.

Prognosis.—As far as the risk to life is concerned the prognosis is quite good, provided there is no serious involvement of the heart. Recurrences are very frequent. A valvular inflammation may be present without permanent involvement or crippling of the valve, but owing to the possibility of recurrence, with little or no joint symptoms and severe heart involvement, the prognosis should be guarded.

Treatment.—The first positive indication is to put the child to bed and keep it at rest until all symptoms have disappeared. The diet should be largely liquid at first, with no meats or animal broths. Plenty of water should be insisted upon. Milk or any food in which it enters should be the chief diet. There are no objections to occasional feedings of the cereals, especially if a diastase be given afterward. With the subsidence of the fever, meat extracts or broths can be given; finally scraped beef, fowls and vegetables.

The bowels must be carefully regulated, and if possible one of the salines given each morning. Sodium phosphate in half or full teaspoon doses, well diluted, is of benefit.

The affected joints are made more comfortable if protected by the application of a cotton bandage, without pressure. A local application of a lotion suggested by Fuller is of service:

R Sodium carbonate	3vi
Laudanum	3i
Glycerine	3ii
Water	3ix
M. et. ft. Sol.	

The application of analgesic balm (Bengue) to the joints is also of service in allaying pain; other remedies suggested are chloroform liniment and mesotan.

Internally some form of salicylic acid is positively indicated,

depending upon the condition of the stomach and its tolerance. Fuller also recommends the administration of alkaline remedies, the formula suggested being as follows:

℞ Sodii salicylatis 3i
 Essentia pepsin (N. F.)
 Aquæ dest. q.s. ad f℥ss
 M. ft. Sol.

Sig. One teaspoonful at a dose at two hours interval.

Salophen in three to five grain doses is beneficial also.

Aspirin in 3 to 5 grain doses. Salicin in 3 grain doses. Salipirin and salophen in 3 to 5 grain doses.

After the acute symptoms have subsided, one of these preparations should be given for a week or more, and the salicylate of colchicum, in the form of the Pil. Colchisal (Fougera) is of great benefit.

For the pain and restlessness, opium in some form may be indicated, Dover's powder, morphine, codeine or heroin, in appropriate doses.

Iron for the anemia in the convalescence is most important, and should always be given either alone or with cod liver oil. In the event a severe heart lesion develops the application of an ice bag to the precordial region is indicated. This allays the pain and discomfort of breathing and limits the amount of permanent involvement of the valves. Digitalis should be employed *only* when indicated by failure of compensation, always judiciously and in as small doses as possible.

When the patient is allowed to get up flannel underwear or a wool and cotton mixture must be worn in winter, and a thinner cotton underwear in summer, being careful to protect from exposure at all times.

DIABETES MELLITUS.

Definition.—As in the adult this is a disease characterized by a polyuria charged with sugar; thirst accompanied by wasting. It is not a frequent condition in children, but is rapidly fatal in the majority of cases.

Frequency.—Out of 3014¹ cases 394, or 13 per cent, occurred in children under 15 years of age.

Etiology.—It occurs infrequently before the end of the first year and more often between 5 and 10 years. Sex and race have little part in the causation, though slightly more females were affected, but heredity plays a decided part in it. Trauma, falls or blows upon the head have been suggested as a contributing cause. Exposure, tuberculosis, the infectious diseases and a diet too rich in sugar and starches begun too early have been mentioned as causes.

Wilcox² found excretion of sugar in the urine after the ingestion of from 15 to 20 grains of glucose, and concludes that children care for sugar as well if not better than adults. He puts the glucose capacity for the first ten years as 30 to 60 grains.

Pathology.—Practically nothing of a definite nature is known of the pathology of this disease. A nephritis is often present, parenchymatous in type. The pancreas shows a variety of changes, atrophy or enlargement, and either hard or soft, congested or normal. Calculus in the pancreatic duct has been mentioned.

Symptoms.—Frequent urination is the principal symptom, with progressive and often rapid loss of weight in spite of an increase in the appetite. The increase in the thirst is marked. Headache may be a prominent symptom and the child may be irritable and peevish, and there is usually an odor of acetone to the child's breath and secretions. The skin is dry and harsh to the feel. Loss of strength is in proportion to the emaciation.

The urine is abundant, varying from 700 to 7000 cc. in 24 hours, clear, and of a high specific gravity, and contains sugar and frequently albumen. The sugar varies in amount according to the time of day it is examined, lowest at night, highest at midday. Hyaline and granular casts are apt to be present, and have been considered a forerunner of coma. Acetone, diacetic acid, oxybutyric acid may be present and are of grave significance.

The blood shows an increase in sugar.

¹ Wilcox: Archives of Pediatrics, September, 1908.

² Loc. cit.

The *duration* in recorded cases varies from four days to two years.

The child which may have been able to retain its urine all night begins to have enuresis and requires frequent changing both day and night. More urine is passed, usually during the day.

Complications.—*Furunculosis* frequently occurs, and *pruritus* is quite common. *Tuberculosis* is given as a common complication. Diabetic *coma* is the usual fatal complication. Its forerunner is the peculiar sweetish acetone odor to the breath, a cessation in the restlessness and increased hebetude and tendency to prolonged sleep. When the coma becomes profound its duration is very short and a fatal termination prompt. Cyanosis follows the irregular breathing which soon sets in, the extremities are cold and pulse weak and rapid.

Diagnosis.—This is not usually made early because of the failure to make urinalyses promptly in children's diseases. The association of symptoms should cause the condition to be suspected, viz., increase in the urine, thirst, increased appetite and wasting, and an examination of the urine to be made.

Prognosis.—This is always grave, as death follows very soon after a diagnosis is made. It is one of the most rapidly fatal of the diseases of childhood. The progress and course of the disease is best learned by the amount of sugar excreted, quantity of acids in the urine, the weight and amount of urine passed in 24 hours.

Treatment.—Breast feeding should be encouraged. Endeavor to find which form of carbohydrates is best borne. This is learned by frequent urinalyses while the different starches are given. The presence of diacetic acid in the urine is an evidence that more carbohydrate is needed. Modified milk should be rich in fat content if no special acidosis is present, and saccharin used instead of the sugar for carbohydrate content. In older children, meat, eggs, green vegetables, animal broths and meat juices.

Drugs offer but little hope of amelioration. Codeine sulphate is the only medicinal treatment of value. One of the forms of opium can be tried with arsenic. Benzosal in 3 grain doses for

its effect on the intestine can be given. For the acidosis, the bicarbonate of soda is specially indicated.

TUBERCULOSIS.

Etiology.—The tubercle bacillus is the active causative agent of tuberculosis. Two chief characters of bacilli are described, the *human* and the *bovine* types. The human type is a rod shaped, colorless, acid fast bacillus with rounded ends, and slightly bent. The bovine type has blunted ends, is thicker and oval in shape. They are resistant to cold but are destroyed by heat and sunlight.

Children of tubercular parents inherit a tendency to tuberculosis. Other contributory causes are adenoids and enlarged tonsils; bad hygiene; improper feeding; prolonged illness; overcrowding in schools and homes.

Pathology.—Every organ or tissue of the body is subject to the invasion of the tubercle bacillus. These may be localized in individual organs or there may be general dissemination of them.

Glands.—A proliferative inflammation takes place in the glands of the body, those situated near the most frequent port of entry of the infecting organism being the ones most actively affected, viz., bronchial, cervical and mesenteric. The bacilli are carried through the lymph channels direct to these scavengers of the body. The following changes may occur in the gland: 1. Chronic proliferation of the gland tissue, enlargement. 2. Degeneration, cheesy or fibroid. 3. Abscess, breaking down of the gland due to infection with other organisms. 4. Calcification.

The tendency in these glands is to hold the infection as a local process, and is an evidence of the leucocytic fight being waged, an attempt of nature to prevent a general infection or an invasion into more vulnerable areas.

The frequency of postmortem findings of bronchial lymph nodes is significant of the possibility that the tonsils and respiratory mucous membrane are most often the port of entry.

Intestines.—Tubercular ulceration here is the same as from other causes, and but for the surrounding glandular involve-

ment or bacteriological examination would go unrecognized as such. The typical tubercle of the mucosa may be found.

Meninges.—The chief changes in tubercular meningitis are to be found at the base along the vessels, though miliary tubercles may be found scattered over the entire pia. The inflammatory exudate may be quite thick and over the entire brain. The younger the child the more severe the inflammation.

Kidney.—The most frequent form of involvement here is of the pelvis of the kidney, the bacilli being easily demonstrated in the pus. Care should be taken to differentiate the tubercle bacillus from the smegma bacillus, which can be done by a more lengthy decolorization period.

Lungs.—The lesions of tuberculosis in the lungs of the child are much like those in the adult. With a predominance of the lymph nodes around the bronchi and trachea. The process usually begins with a gland as a nucleus, and spreads baseward rather than toward the apex as in the adult.

Port of Entry.—A child being so much closer to the floor or ground when walking, and when younger being on the floor at play frequently, is much more open to infection from dust, infected toys and hands, than an adult. The infection may occur through the mucous membrane of the tonsil, even though unbroken, or carried directly to the lungs through the bronchi.

The intestinal mucous membrane may allow the bacilli to enter without an abrasion being present, and it has even been stated by one observer that pulmonary infection *more frequently* occurred from the bacilli gaining entrance through the intestine than through the bronchi. That it does so occur is proven beyond doubt. Skin abrasions may allow the entrance of the bacilli.

The lesion found may not be any guide to locating the port of entry.

The ingestion of the bacillus in milk is a positive source of infection. Infected milk and butter, nipples, toys, the mouth in kissing, dirt under the nails, are also conveyers of the bacilli.

Frequency.—During the first year less frequent than afterward. Schwer found 14 per cent of the children autopsied be-

tween 2 and 12 months to be tubercular. Cornet published result of analysis or records of Berlin Pathological Institute, which showed of 947 children dying between 1876-1891, 22 per cent showed tuberculosis; Still found 35 per cent in 769 postmortems. The greater number of deaths occur between two and four years. Jacobi and others have reported cases of fetal tuberculosis.

General Symptoms.—The development of tuberculosis in children may be very insidious. In all forms the child shows a certain departure from normal, which is apparent to the careful mother or nurse. There is a listlessness or heaviness not ascribable to anything else. The appetite is capricious and the disposition variable, rather an inclination in sunny temperaments to tantrums and moodiness.

There is a beginning pallor, the flesh loses its firmness and the step its elasticity; and if weighed there is an appreciable loss in body weight.

Unexplained temperatures are frequently found to be due to an acutely inflamed ear without much pain, or a beginning involvement with tuberculosis.

Mouth breathing is frequently a prominent symptom, from a collection of adenoids in the nasopharynx, the tonsils are enlarged and the nasopharynx red. Exhaustion is easily produced, these cases having but little endurance. They will play vigorously for a short while, but stop suddenly, lying down, perhaps, wherever they may be, often complaining of being tired.

The pulse is not full, usually much quickened and "irritable." Respiration is hurried, especially on the least exertion.

Anemia is a prominent and early symptom, shown in a decided decrease in hemoglobin, and some diminution in the red blood cells. Very acute cases show less blood change than the more chronic ones.

Clinical Varieties.—The special symptoms of the numerous clinical types of tuberculosis vary according to the region or organs affected. The general symptoms just enumerated are more or less common to all of them.

Glandular Tuberculosis. (Tubercular Adenitis.)—Tubercular enlargement of the bronchial lymph nodes may never be recognized clinically, but at autopsy beginning at the bifurcation

of the bronchi the glands are found much enlarged. Cervical adenitis is comparatively frequent. To differentiate an adenitis of other origin may be difficult. The tubercular gland, however, usually enlarges slowly but continuously, without much local disturbance and with practically no pain on palpation. As the deeper glands enlarge they become matted together, perhaps become adherent to the skin and form large irregular, nodular masses. They may remain quiescent for varying lengths of time, ending in caseation or pus formation with discharge of the pus through a fistulous opening which may require surgical intervention. The subject of surgical removal of tubercular glands, especially when about the neck, has been thoroughly discussed, with a preponderance of opinion in favor of noninterference. Dissemination of the local tuberculosis into a general miliary tuberculosis has been ascribed to removal of glands of the neck.

Appetite is very changeable, at times good, at others very poor. Sweets are usually craved.

TUBERCULAR MENINGITIS.

This may be a local manifestation of tuberculosis or a sequel to an infection elsewhere.

Etiology.—This disease is due to a direct invasion of the meninges by the tubercle bacillus. The bacilli may localize in the meninges as a primary affection, absorbed, perhaps, from the nasal mucous membrane direct; or they may be carried through the lymph or blood from tubercular foci elsewhere, the lungs, lymph nodes, joints, abdomen, etc. Lack of resistance from previous illnesses is usually present as a determining factor. There may be a history of previous attacks of enterocolitis, pertussis, bronchitis, bronchopneumonia, the exanthemata, middle-ear disease, from which the child never fully recuperated.

Age is an important factor in the etiology. Children are much more often affected, especially between the ages of two and ten, the average age being about four years.

Pathology.—The pathological changes vary greatly. Autopsy findings may be very slight in the severe and rapidly fatal cases, and the protracted ones may show severe lesions.

The *brain* may show changes which vary from a few scattered grayish tubercles along the vessels in the fissure of Sylvius, to a thick, inflammatory exudate over the entire base. The effusion may be thin and seropurulent, and extend into the fissures of the brain and well up on to the convexity. Accumulation of fluid in the ventricles is usually found, distending them fully.

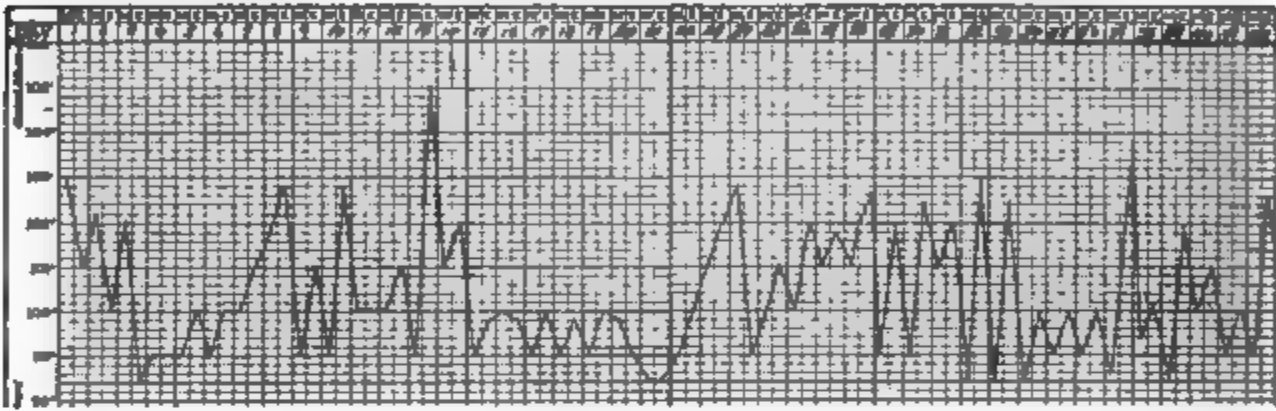


Fig. 61

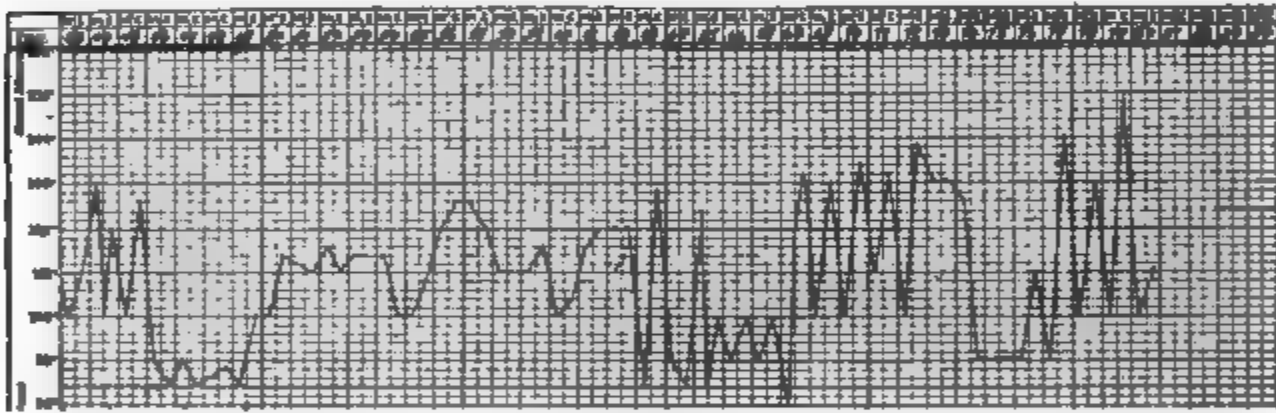


Fig. 62.—Temperature for 81 days in child with general tuberculosis, ending in tubercular meningitis.

The process may extend into the cord. The pia mater is infiltrated.

The lungs may show unresolved areas of pneumonia, perhaps with cheesy disintegration, the *bronchial glands* are also enlarged and some broken down or softened. The *mesenteric glands* are usually enlarged, perhaps disintegrated or softened. The superficial *lymph nodes* may be found enlarged, also the tonsils.

Symptoms.—But few diseases present so varied a picture at the onset as tubercular meningitis, and in consequence the diagnosis in the majority of cases is not made during the early stages.

The *onset* is practically always insidious except in a very few cases in which convulsions may usher in the attack. For a very varying length of time the child is not normal, is listless and peevish, not inclined to play, restless at night, no appetite, and if old enough may complain of headache. Nausea may be present with slight gastrointestinal disturbance, sufficient to look upon it as the cause of the indisposition. There is a slight rise of temperature, not much more than 100.5° F., more or less continuous and without decided remissions. In one case seen in an adjoining city recently, because of the fever, a tentative diagnosis had been made of malaria, and later of typhoid fever. After a few days the vomiting may be a prominent symptom, recurring often and without provocation. Constipation is the rule in this stage.

After a varying length of time, rarely longer than two weeks, the signs of *acute inflammation* take place, and the diagnosis is plain. There is a rise in the temperature to 101° F. or 103° F. I have not seen the temperature very much above 104° F. in this form of meningitis, though 106° F. has often been reported. Before this time the patient could be roused, often with difficulty, but from now on there is more or less deep stupor, from which it cannot be roused. It will swallow when liquids are placed between the teeth, but later cannot do this.

At the beginning of this stage, for a brief period usually, the characteristic symptom, Cheyne-Stokes' *respiration* takes place. In two of my cases recently, this symptom was present early in the inflammatory stage for 24 hours and disappeared, returning a few hours before death in one of them.

The *pulse* is very variable, at times rapid, at others slow, being also irregular in volume.

Vasomotor phenomena are present, alternate flushing and blanching of the cheeks, and the *tache cerebrale* is usually present at this time.

The abdomen is retracted, as a rule, giving the typical "scaphoid belly." The pupils are usually unequally dilated and fixed, though they may be equal. The conjunctival reflex is absent and a squint may be present.

There may be general convulsions at this stage, or only slight convulsive movements of the facial muscles and the extremities. Rigidity of the neck usually develops early, and as the disease progresses there may be opisthotonos more or less marked.

From this time the child develops into the stage of *coma*; the pulse is very rapid, the respirations shallow and irregular, the sphincters relaxed. The temperature just before death may rise very rapidly, but usually does not.

Kernig's sign and the Babinski reflex are found in perhaps the majority of cases.

Death, which is inevitable, may be preceded by general convulsions.

The duration is very varied, lasting from one to six weeks, with an average of perhaps three weeks.

Diagnosis.—The chief aid in the diagnosis of the form of meningitis present is a consideration of the previous personal and the family history of the child.

Acute meningitis usually develops suddenly, and all of the symptoms are more acute from the onset, shorter in duration, and with higher temperature.

The low, continuous fever is suggestive of typhoid, and in suspicious cases the Widal and diazo tests should be made, and if still uncertain at the end of the second week, repeated.

Lumbar puncture may be of great assistance in clearing up the diagnosis (see page 516). The fluid is then examined for the tubercle bacilli, pneumococci, staphylococci, etc. It usually escapes under increased pressure.

Prognosis.—The positive diagnosis of a case of tubercular meningitis is the equivalent of signing the death certificate in advance. If a case of meningitis recovers in which the clinical diagnosis of the tubercular form has been made, without isolation of the bacilli in the spinal fluid, the original diagnosis was in error.

Treatment.—This is purely symptomatic, and of no avail as far as a cure is concerned. Chloroform for control of the convulsions, with bromides and chloral; liquid diet; ice bag to head and spine; stimulants when indicated, absolute quiet, etc.

TUBERCULAR PERITONITIS.

While comparatively rare, in children, this variety of peritonitis is seen in children. The bacillus may find original lodgment in the peritoneum but is more often transported from mesenteric lymph nodes or other more remote port of entry.

Pathology.—Several forms are described, the *ulcerating* form in which the intestines are matted together and adherent, the *fibrinous* form in which the intestines are covered with a thick, purulent exudate through which are seen the *miliary* tubercles, and a matting together of the intestines, and the miliary form with ascites. There are numerous miliary tubercles scattered over the intestine and parietal peritoneum, a serous or sero-purulent fluid escapes on incision of the abdomen in which float flecks of fibrin. Numerous adhesions are present both of coils of the intestines to each other and to the parietal peritoneum.

Symptoms.—The miliary form with ascites is most frequent in children, and the diagnosis is usually not made early because of the insidiousness of the onset. There may be a few indefinite digestive disturbances with moderate rise of temperature, perhaps some pain in the abdomen, followed sooner or later by gradual enlargement of the abdomen from accumulated fluid. The appetite is variable, the bowels irregular with occasional attacks of vomiting. Before the abdomen becomes tense from accumulated fluid careful examination may reveal nodules and enlarged mesenteric glands. Percussion of the abdomen in changed position may show the line of fluid, fluctuation can also be obtained.

Treatment.—Surgery offers the best results in the ascitic form. An incision should be made through the abdominal wall, with evacuation of the fluid and immediate closure, without drainage. After convalescence from the operation, the patient should have fresh air, judicious feeding, quiet, cod liver oil and other tonics as indicated.

With the development of pathologic changes in the lungs symptoms referable to this region appear. Cough, without expectoration, except in much older children, as the young always swallow material raised from the bronchi or trachea. If pleurisy is present, there is usually pain and friction sounds over the

area involved, and an examination will show signs peculiar to the stage of the degeneration. Bronchial glands may give impaired resonance or high-pitched breathing, if constricting either or both bronchi. If the process has been engrafted upon an unresolved pneumonia, the pneumonic signs persist with addition of signs of degeneration, localized fine, moist rales, with approach to cavernous breathing as breaking down occurs. Pulmonary hemorrhage is quite uncommon in children. The following history is a typical one of acute tuberculosis in a child:

L. H., nine years old, was first admitted to the Masonic Home January 22, 1895, the physician's certificate stating that both parents had died of phthisis pulmonalis.

Examination on admission showed hypertrophied tonsils, necrosed molar teeth and a peculiar listless expression.

For some weeks after admission it was noticed that she was dull and apathetic, having little to do with the other children, apparently preferring to be alone. She had peculiar, expressionless eyes, with slight divergent strabismus of the left one.

She was admitted to the infirmary on the 14th of April, having had a chill on the previous day. She was given 9 grains of quiniæ sulphas, daily for five days, after receiving 1 grain of calomel on the first day, with no effect upon the temperature. Examination at this time showed her to be very anemic and much thinner than on admission. She was content to lie quiet for hours, with a vacant stare, but would answer questions in monosyllables, never venturing a remark or making her wants known.

On May 20 the following notes were made: Very pale, much wasting since admission; glands of neck, anterior and posterior, submaxillary and sublingual markedly enlarged, some to size of hazel nuts, some larger. Inguinal glands slightly enlarged to about the size of a pea. Abdomen relaxed. No mesenteric enlargements made out. Harsh breathing found over posterior aspect of chest, otherwise negative. Some faucial congestion with tonsillar enlargement.

Diagnosis of general tuberculosis with, perhaps, beginning tubercular meningitis. On May 23 she was seen by the consulting staff, the diagnosis of general tuberculosis being concurred in.

She was put on nourishing diet and tonic treatment. She would not stay out of bed, and gradually grew weaker from day to day.

From June 23 she complained continuously of severe headache, crying out with pain.

On July 1 she had a general convulsion, contractions of flexor muscles of arms and legs being present for some time. Both pupils were dilated equally. Large doses of potassium bromide were given without effect.

During the night of July 1 she had many general convulsions, lasting two or three minutes. During the morning of the 2nd day she lay in a stupor, perfectly relaxed; she coughed considerably; the pupils were equal and the pulse regular. She died quietly at 3 p. m.

Autopsy. On the morning of the next day, 18 hours after death. Rigor mortis marked. Body much emaciated.

Chest. Lungs. Tubercular nodules and patches of tubercles distributed over the surface and borders of both lungs. Slight hypostatic congestion. Section shows apices thickly studded with tubercular nodules. Bronchial glands enlarged and in a state of fibrous degeneration, not cheesy. Most marked enlargement of glands at bifurcation of trachea and along primary bronchi. No pleural adhesions. Heart and pericardium normal. A lumbricoid worm 6 inches in length was found in the esophagus.

Abdomen. Peritoneum and mesentery thickly studded with tubercles. Mesenteric glands enlarged and fibrous. Appendix vermiformis 3 inches long, lying in the right iliac region.

Head. An excess of cerebrospinal fluid on opening calvarium. Dura, normal. Brain (macroscopic examination by Dr. Carl Weidner) is large, symmetrical. The pia mater is rather firm. It is cloudy, in some portions distinctly yellowish, both at the convexity and at the base. At the vertex it can be detached without any difficulty. At the base it is markedly adherent in places, and especially so at the fissure of Sylvius. These adhesions are quite firm. In addition the pia shows some minute whitish-yellow, cloudy spots, and similar granules at the base of the anterior lobes, also an increased vascularity. Along the superior longitudinal fissure there are an unusually large number of Pacchian granulations.

The lateral ventricles having been torn open on a level with the corpus callosum (in transportation over rough streets after removal) contained no fluid. The cavities seemed large. No signs of disease at the large basal ganglia.

The medulla and cerebellum showed nothing abnormal.

The case is reported principally on account of the interest attached to it in connection with the temperature chart, a record of the 80 days of acute trouble. (Fig. 62.)

Diagnosis.—With the ordinary methods employed diagnosis of tuberculosis is at times a most difficult thing. Any continuous, irregular fever, in a child presenting the symptoms enumerated above, especially anemia, loss of appetite and strength, which cannot be otherwise explained, is very suggestive of tuberculosis. This is especially true when there has been a history of exposure. I have recently had under my observation a child in whom tuberculosis was strongly suspected because of a per-

sistent temperature which was later found to be due to an involvement of the middle ears.

The use of tuberculin for diagnostic purposes has recently been proven of great service. It can be employed in the form of a subcutaneous injection of the original tuberculin (Koch), by the *conjunctival* or the Calmette method, and by the *cutaneous* method of von Pirquet.

In the *ophthalmic* test the solution used is prepared as follows:

The tuberculin is precipitated by the addition of 95 per cent alcohol to concentrated T. O., or Tuberculin Original (Koch). The precipitate is collected on filter paper and washed with 70 per cent alcohol until the filtrate runs clear. It is dried in vacuo over H_2SO_4 and afterwards ground into a powder. The powder is dissolved in sterile normal saline solution of 1 per cent by weight, heated in a water bath and filtered through paper. It is diluted as desired and filled into capillary glass tubes, which is then sealed and boiled for 10 minutes in a water bath. This insures a perfectly sterile solution, being instilled into the eye.

Two solutions are employed in order to avoid unnecessarily severe reaction, No. 1 contains 0.5 per cent, and No. 2, 1 per cent. The No. 1 solution is used in one eye, and if no reaction is obtained in 48 hours No. 2 solution is used in the other eye. It is quite possible that the unpleasant effects reported in some cases is due to a too strong solution. Brown advises a 1:250 solution in one eye and 1:100 solution in opposite. The method of application is as follows: One end of the capillary tube holding the solution is passed through the small rubber bulb, and a minute portion of both ends is broken off, and the tube slipped back into the bulb. The end of the tube from which the drop to be expelled is carefully wiped with sterile gauze or cotton to remove any spiculæ of glass. The lower lid is held down, and by holding the tube parallel with the eye 1 drop from the tube can be squeezed on to the mucous membrane at the outer canthus. The lid is so held as to form a sac, the solution being evenly distributed over the lid without allowing it to overflow on to the cheek. Occasionally a very slight smarting

sensation is complained of, but this is momentary. It is advisable to warm the tubes to body temperature if they have been kept in a cool place. The tested eye should be protected from external irritation, rubbing, wind, dust or smoke.

The reaction described by Calmette is seen on an average at about seven hours after the inoculation, though it may be delayed for 24 hours or even 48 hours. The first sensation is that of a scratchy feeling, lacrimation and redness, to a more severe one of severe injection of the conjunctiva and swelling of the lids. A stuffiness of the nostrils on the corresponding side accompanied by a slight coryza. Park suggests the following classification of reaction:

0 Negative: No difference in the color when lower lids are pulled down.

? Doubtful: Slight difference, with redness of caruncle.

+ Positive: Distinct palpebral and ocular redness, with secretion well marked.

++ Deep injection of entire conjunctiva with edema of lids, photophobia and secretion.

The reaction may continue for a week and gradually subside. In a small percentage of cases there is a slight rise in temperature, but this is not often high.

Both eyes should be closely examined before the inoculation to be certain there is no redness present. The presence of a distinct disease of the eye or lid is a contraindication for its use, as conjunctivitis, blepharitis, trachoma, iritis and keratitis. If a marked reaction is noted, the conjunctivitis can be controlled by the use of a boracic acid solution wash, or a 2 per cent cocaine solution with or without a drop of a 1:1000 solution of adrenalin.

The *cutaneous method* of diagnosis consists in a scarification like an abrasion for vaccination against smallpox, under the drop of tuberculin after the method suggested by von Pirquet. Two abrasions are made, about an inch apart, one being used for control, the control abrasion being made under a drop of 50 per cent glycerine and .1 per cent phenol in normal salt solution. Koch's original tuberculin is used, diluted with one

part of a 5 per cent carbol-glycerine solution, and two parts of normal saline solution.

Wolff-Eisner describes the reaction in the cutaneous test as follows: The early reaction occurs in about three hours, beginning with slight redness which reaches its height in 24 hours, and has faded largely in 48 hours. In a few hours a papule appears, more plainly felt than seen, and in very occasional cases a bleb is formed.

In the late reaction the redness and papule may be delayed until the fourth day, or increase gradually until the fourth or fifth day, and may persist for three or four weeks. Enlargement or tenderness of the glands in the axilla may be present. The reaction is described in this form as the normal reaction of the tuberculous individual; the late reaction, which may be marked strong or unusually strong; the quick, but very weak and fleeting reaction which may be overlooked.

The *subcutaneous* method consists in the injection of 1/10 mg. of the original tuberculin (Koch). If there is no reaction following its initial administration, a second dose may be given after a lapse of two or three days, gradually increasing by 1/10 mg. doses up to 3 or 4 mg. Brown advises giving the injection at night, when, in a majority of instances, the reaction occurs in 8 to 20 hours. It may occur in four or five. Late reactions, second or third day have been noted. On this account the injection should be given every third day. A "reaction" is evidenced by "pain, tenderness, redness and swelling at the site of the injection, headache, malaise, an increased tendency to cough, probably more or less expectoration than usual, and at times some gastrointestinal symptoms as nausea and vomiting." There may be a rise in temperature also, and if this amounts to 2° F. it is fairly characteristic.

The *Moro* reaction is obtained by using a 50 per cent ointment of tuberculin and lanolin. A piece of this the size of a pea is rubbed into the axilla. In 24 or 48 hours, in the presence of tuberculosis an eruption of macules and papules appear which persist upwards of a week.

Owing to the unfavorable reports of the ophthalmoreaction,

which are becoming more numerous, the cutaneous or vaccination method is recommended as the most desirable test.

The laboratory is an aid to diagnosis of this condition in children, but owing to the infrequent successful attempts at obtaining a sample of sputum, and the difficulty of finding the bacilli in the feces, it is not as frequent an aid as might be hoped for. By closely examining the blood and mucus in suspected intestinal tuberculosis the bacilli may be found. In malaria or typhoid fever the organism peculiar to these conditions may be found.

In tubercular pyelitis and cystitis the bacilli may be isolated. The smegma bacillus must be differentiated in the urinary examination, the urine being obtained by catheterization performed in the most aseptic manner.

Blood examination may show in the early stages an increase in the polymorphonuclear cells, later the mononuclears may predominate.

Prevention.—Prevention of tuberculosis in infancy is most important. The source of milk supply must be known, and only certified milk and inspected butter used.

A child should never be allowed to come in contact with a consumptive, or to visit a house in which it is known there is a consumptive. Kissing children in the mouth should never be permitted.

Treatment.—The same general principles of treatment of tuberculosis in children should be instituted as are employed in adults. If a sanitarium is possible, it will be found very easy to adapt a child to the routine sanitarium life. Children do not stand well either a very cold climate or a warm, enervating one. Absolute rest in bed, in the open air, should be insisted upon at first, and exercise allowed very moderately and carefully. This treatment is indicated in surgical tuberculosis as well.

Children stand forced feeding when properly instituted, very well, indeed, milk and eggs, being the best borne for the extra diet. Only "Certified" milk should be given when it is obtainable, if not the milk should be carefully Pasteurized.

The original tuberculin is used, the dosage varying accord-

ing to the patient and its age, 1/12000 to 1/8000 mg. for a child of one year of age.

The beneficial effect of tuberculin could be substantiated by a number of reported cases.

Medication is of secondary importance to a carefully regulated diet. Tonics undoubtedly have their indication, when judiciously employed, especially when there is a failure of appetite or a disgust for food. Cod liver oil can frequently be taken either pure or in emulsion to great advantage. Iron, the carbonate, citrate or muriated tincture, syrup of the iodide, diast iron, will be found of benefit. Preparations of malt may often be used to advantage.

Baths followed by a general rub with olive oil or cod liver oil in the poorly nourished are most beneficial remedies.

The importance of life in the open, especially for those children living in the close quarters of the poorer classes, cannot be overestimated. Open air schools for the tubercular child or the child who shows a tendency to a tubercular diathesis have been most successful. Proper attention to clothing, rest, and food for the child in the open air school is necessary for good results.

PELLAGRA.¹ (*Pelle, skin; Agra, rough.*)

This is a disease which prevails in the Southern States, notably North Carolina, South Carolina, Mississippi, Alabama and Texas.

It is a toxemia, supposed to be directly due to eating damaged corn, and is manifested by disorders of the nervous system, digestive system and localized erythemas of the skin.

Pellagra has been known since 1755, the first cases occurring in Spain, followed by others in Italy, France and Egypt. It has occurred in South America and Mexico, and in this country in Alabama, at the Mt. Vernon Insane Asylum, first reported by Dr. Searcy in 1906. Since this time many other cases have been seen.

Etiology.—Eating damaged corn is believed to be the direct cause of this disease. Bad hygienic surroundings and insuffi-

¹ I am indebted to the writings of Dr. Geo. H. Searcy, Tuscaloosa, Ala., for much of the data of this chapter.

cient nourishment of other kinds are contributory causes. Corn is usually consumed in the South as cornmeal and grits, and these when moulded, contain fungi and bacteria. Searcy likens the condition under discussion to gangrenous ergotism, and believes the smut (*ustilago*) resembles the ergot of rye very much, and that corn smut is the cause of pellagra.

The direct action of the sun's rays is believed to be a contributing cause of the skin lesions of pellagra, these occurring chiefly upon the exposed parts of the body.

Symptoms.—Cases of pellagra are either acute or chronic.

The first symptoms of the *acute* form are a marked lassitude and weakness, followed by loss of flesh and varied gastrointes-



Fig. 63. Pellagrous dermatitis, dry form, with exfoliation of the skin. (Roberts: *Pellagra*)

tinal symptoms. The duration of this stage may be some weeks. The acute symptoms begin by a salivation and symptoms of indigestion, perhaps pain and tenderness in the epigastric region, followed by diarrhea.

The skin lesions develop about this time, chiefly the exposed

parts of the body being affected, limited to the extensor surfaces of arm and hand, dorsum of feet, face and neck. The lesions are symmetrical. The appearance of the skin is a deep red, and a decided anesthesia in the part affected. The affected skin either forms bullæ and blebs or becomes scaly and thickened. If the vesicles form they rupture and leave a denuded area which is moist. The nervous symptoms are soon manifest, not so marked in the early acute stage as when the disease becomes chronic. The chief mental symptom is a depression which grows more marked if the case becomes chronic. There is pain and tenderness in the dorsal region close to the spine, with exaggeration of the patellar reflexes. Later the reflexes are either lessened or absent. Insomnia is a marked feature from the beginning.

The temperature may be elevated a degree or two, but is more often subnormal.

The acute cases may prove fatal in a few days after they have to go to bed; may lapse into a chronic condition or may recover. If recovery takes place the improvement is slow, taking several months to return to normal.

In the *chronic* form there may be a history of an acute attack shortly before, or, as is more common, an attack during the previous summer. The skin, which has been the site of the eruption, is thick, wrinkled and scaly.

The pronounced mental symptoms, depression and melancholia, usually do not become noticeable for a year or more, but as the disease progresses the mental symptoms are so severe as to necessitate confinement of the patient in an asylum. Dementia is the usual final outcome.

Contractures of fingers and even of arms or legs are common late in the disease.

Diagnosis.—The association of the following symptoms is sufficient to make the diagnosis: Location of erythema, vesicles, etc., on the extensor surfaces of the exposed parts of the body; salivation, stomach disturbances and diarrhea; mental depression, and the history of the corn diet.

Pathology.—Fatty degeneration of the internal organs; pachymeningitis and degeneration of the posterior nerve roots and

posterior columns of the cord, and in the dorsal region, in the lateral columns, and the changes in the skin. There is also anemia and emaciation.

General atrophy of muscles of body and the walls of the stomach and intestines take place in the chronic cases.

Prognosis.—A mortality of 58 per cent was reported at the Mt. Vernon Hospital. Death usually occurs within three weeks of the time the patient goes to bed. When recovery takes place it is slow.

Treatment.—The principal treatment is dietetic. Remove from the list of food all corn in any form. Give animal broths and milk. Do not keep the patient in a bright sunlight.

Medicinally, arsenic is indicated. Searcy recommends it in the form of atoxyl, gr. iss doses, once a week hypodermically, increasing to 2 grains.

MALARIA.

By Wm. Britt Burns.¹

Synonyms.—*Malaria*; *ague*; *paludism*; *intermittent fever*; *paludisme* (Fr.); *Wechsel fieber* (Gr.); *paludismo* (It.).

Definition.—A specific infectious disease, due to the invasion of the blood of several species of the hemosporidia of the genus *plasmodium malariae*. The disease manifests itself, according to the species of infecting parasite, in three types, which are distinguished in common by the occurrence of periodical, intermittent or subintraant febrile paroxysms.

Historical Note.—Contemporaneous writers of ancient times chronicle the fact that malaria then existed. We learn from the writings of A. Groff that malaria was well known to the early Egyptians. The word “Aät” occurring as an inscription on the temple at Denderah, is said to indicate the annual recurring epidemic. Our knowledge of malaria has been moulded for us by the acute observations and fairly accurate accounts of the disease by Hippocrates, Galen and Celsus, before the discovery of Peruvian bark (*Cinchona*), in 1640.

¹ Dr. Burns while a resident near the swamps of Arkansas did a large amount of original work upon the subject of malaria, before taking up, in recent years, a general surgical practice in Memphis, Tenn. At the time the work of Ross, Grassi and Bastianelli was in progress, Dr. Burns checked it in his observations. Dr. J. B. McElroy, of Memphis, has read the manuscript and corrected the proof of this chapter.

With this period are associated the names and work of Sydenham, Torti and Morton. Torti and Morton divided the "essential fevers" into two classes, namely, those that were curable by treatment with cinchona bark and those in which it had no effect. Lancisi was the first to conjecture a relationship between malaria and the telluric, meteorologic and climatic conditions; also to notice the very dark color of the liver at necropsies in fatal cases of malaria. In the eighteenth century de Haen noticed the rise of temperature during the chill.

During the latter part of the eighteenth century rapid colonization all over the world made the differentiation of malaria from other endemic tropical and subtropical diseases difficult indeed. The separation was satisfactorily accomplished in the nineteenth century. So that this epoch ends with the discovery of the malarial parasite by Laveran in 1880.

The characteristic bodies having been found, the study of the mode of infection began to be hypothesized. Nott of Mobile, Ala., in 1848 published a paper on yellow fever, and in touching on malaria wrote as if the mosquito theory had already been advanced. King in Washington in 1883 collected evidence; Laveran in 1891; Bignami in 1896 suggested that the mosquito might be the infecting agent. Koch claims to have thought of it in 1883-4. But Patrick Manson in 1894, was the first to offer argument in support of the "conjecture" as he called it.

The third and grand epoch in the advances of our knowledge was opened by Surgeon-Major Ronald Ross of the Indian Medical Service, who in 1895 began to elucidate and prove Manson's theory, and in September, 1897, after examining a thousand mosquitoes for both avian and human malaria. The Italians, Grassi, Bignami and Bastianelli, in 1898, confirmed the work of Ross.

Etiology.—The *plasmodium malariae*, the infectious agent, is introduced into the human body, by the bite of mosquitoes of a certain variety, namely, anophelinæ, which have themselves been infected by feeding upon individuals, whose blood contained sexual forms of the malarial parasites.

The endogenous cycle or schizogony in a new infection begins with the sporozoites, penetrate healthy red corpuscles,

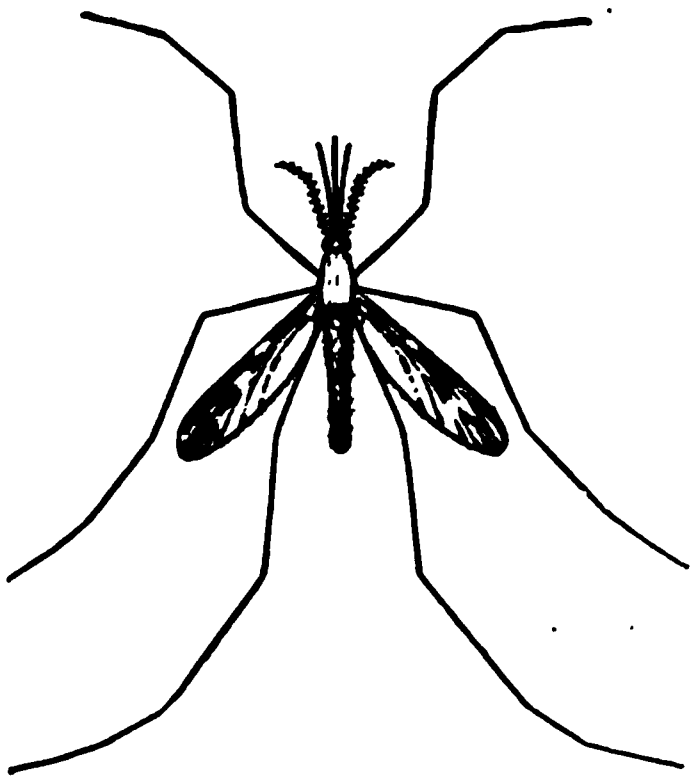


Fig. 64.—*Anopheles Crucians*. Female mosquito, greatly enlarged.

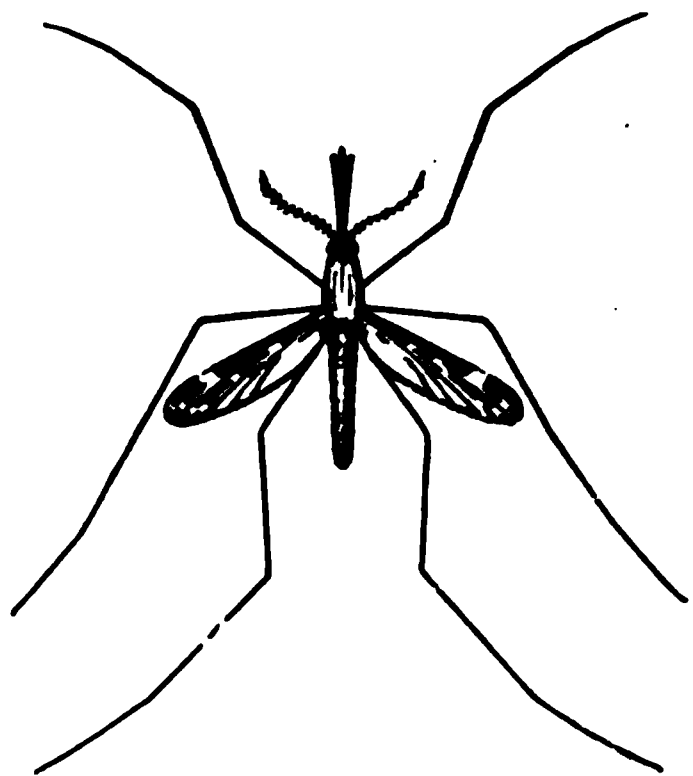


Fig. 65.—*Anopheles punctipennis*. Female mosquito, greatly enlarged.

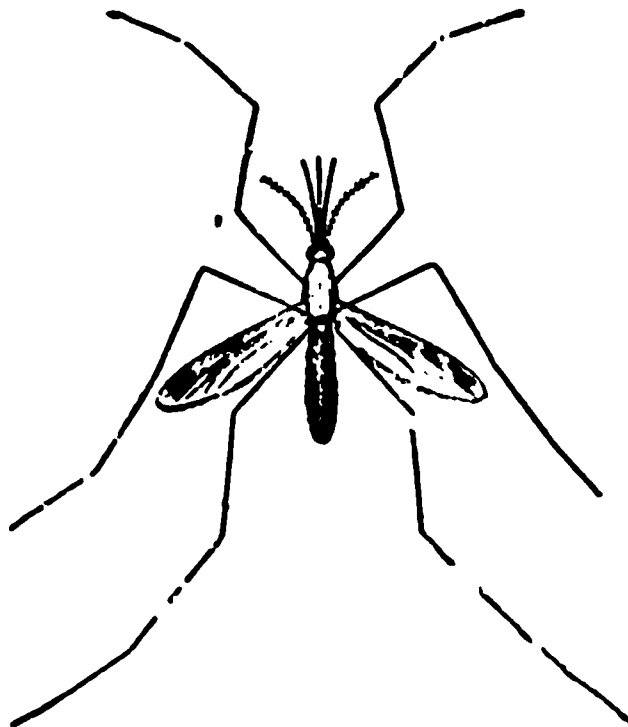


Fig. 66.—*Anopheles quadrimaculatus*. Female mosquito, greatly enlarged.

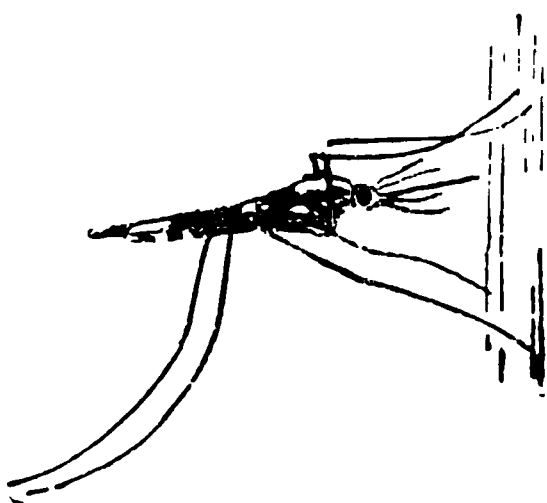


Fig. 67.—*Anopheles* mosquito at rest.

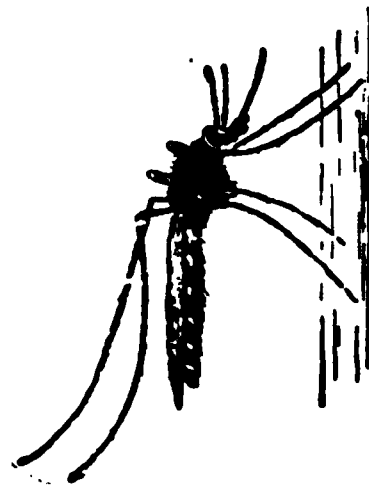


Fig. 68.—Common mosquito at rest.

NOTE.—Figs. 64, 65, 66, 67, 68 from article by Dr. S. P. Lathrop, New York City, published in June, 1913, *Medical Herald*.

barring phagocytosis, becoming trophozoites or ring forms, and later schizonts. These bodies feed upon the red cells, converting their hemoglobin into melanin, reaching their full growth; the segmentation stage, or "roset" form, they divide by schizogony into a number of spores or merozoites. The remnant of the red cell, with its contained pigment, having disintegrated, the merozoites are set free to attack other uninfected and occasionally infected red cells. The asexual or schizogonic cycle is completed.

When the parasites are first introduced into the blood, their numbers are relatively small, hence for a certain length of time no symptoms are produced upon the host, the so-called incubation stage, measuring from 6 to 12 days. During this, it is said, the schizogonic stage only is reached. About this time the reaction of the patient, as in the production of fever, appears to stimulate the merozoites to development into the sexual forms, namely, the male or microgametocyte, and the female or macrogametocyte. If the host is now bitten by the proper mosquito, these sexual forms, with other forms, are taken into its stomach, where the remnants of red corpuscles and their contained pigment and the asexual forms of parasites are digested, etc. The male cells put out flagella (microgamete), which, after a decided hammering motion, are thrown off, and finding the female cells (macrogamete) penetrate and fertilize them. The conjugation stage is called the zygote and the next step the ookinete. When this is accomplished, the ookinete pushes its way into the wall of the mosquito's stomach and begins its growth. The oöcyst is formed; inside of which is developed, first, sporoblasts; second, sporozoites. The oöcyst is seen to be, in size, in proportion to the length of time between the feeding and death of the insect, namely: They may reach a greater size, according to Stephens.

7 microns after two days
17 microns after four days
19 microns after five days
25 microns after seven days (Ross)

The oöcyst having reached its full development ruptures, and a large number of curved, thread-like bodies, sporozoites, escape

into the surrounding serum. These bodies are now ready and fit to be introduced into the host. On staining, the sporozoites contain, centrally located, one or two small masses of nuclear matter, and measure 14 microns in length, tapering at either end. In the unstained, fresh specimens, they exhibit a decided writhing motion.

Quartan Parasite.—The quartan parasite is smaller than the enveloping red cell, when its segmentation stage is reached; it causes the red cell to shrink and usually becomes darker in color. Its full development is accomplished in 72 hours.

Beginning with the sporozoite or ring form (hyalin body), as a pale, refractory spot in the substance of the red corpuscle, usually eccentrically, about 1/10 the size of the containing cell; it feeds upon the hemoglobin, converting this into pigment and proper tissue. The pigment of the quartan parasite is characteristic, in that it is darker and in larger blocks or grains and lazier, than the pigment seen in the other varieties of plasmodia. Between the hyaline stage and the segmentation stage, the different forms are merely larger parasites, with more and more pigment. The melanæmia of malaria is one of its most characteristic features. Two varieties of pigment occur, namely, melanin and hemosiderin; the second is found in the internal organs and gives the reaction to iron; the first is found in the circulating blood everywhere. The quartan divides into from 6 to 10 spores or merozoites.

The Benign Tertian Parasite. *Plasmodium vivax*.—The growth of the benign tertian parasite is exactly similar to that observed in the growth of the quartan; it is, however, very much more rapidly motile, the pigment is finer and keeps up a dancing motion, almost continuously. The containing red cell begins to swell early, and it becomes paler in color. The full-grown pigment bodies (schizonts) may, by the inexperienced, be taken for a pigmented or a granular leucocyte in the fresh blood. The segmenting body, both of the tertian and quartan, have the appearance of the daisy or marguerite. When the cell ruptures the remnant of the cell and its contained pigment are carried to the spleen. Segmentation occurs at the end of 48 hours, setting free 18 to 20 spores (merozoites).

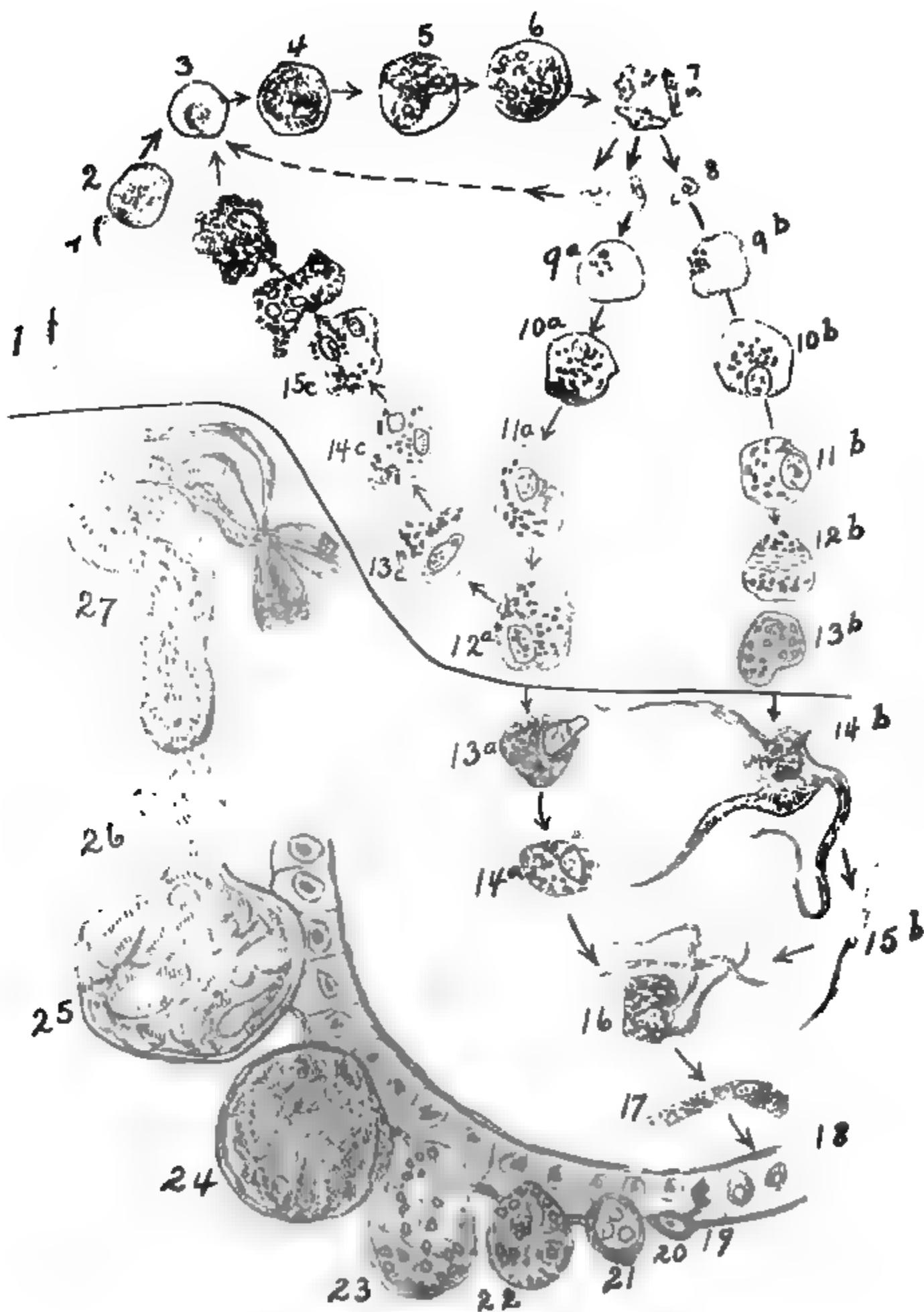


PLATE II.

LIFE-CYCLE OF PLASMODIUM VIVAX.

(AFTER GRASSI AND SCHAUDINN.)

The human cycle is above the transverse line, some rearranged by Kinsalt and Hartmann. The cycle in the mosquito is beneath. 1 to 7, Schizogony, 1, sporozoite; 2, entrance of sporozoite; 3 and 4, growth of the schizont; 5 and 6, nuclear division of the schizont; 7, formation of the merozoites. 8, merozoites; 9a to 12a, growth of the macrogamete; 9b to 12b, growth of microgamete; 13a to 17c, parthenogenesis of the macrogamete; 13a and 14a, maturation of macrogamete; 13b and 14b, growth of the microgamete; 15b, fertilization; 16, trophozoite; 17, ookinete; 18 to 20, entrance of the ookinete into the stomach wall of the mosquito; 20 to 22, sporogony; 22 and 23, nuclear multiplication in the sporont; 24 and 25, formation of the sporozoites; 26, passage of the sporozoites to the salivary gland; 27, salivary gland of the mosquito with sporozoites (Magn. 1 to 17c, 1200 to 1; 18 to 27c, 600 to 1.) Park: Pathogenic Bacteria and Protozoa.

The Estivoautumnal Parasite (*Laverania Malariae*).—The young forms of this variety of malarial parasite are somewhat smaller than either of the other forms; not so motile as the tertian, and does not show the amount of pigment of either. The full-grown bodies are about the size of the red corpuscle; at this stage they show several grains of rather coarse, black pigment. The segmenting body is divided rather symmetrically into from 8 to 25 merozoites. The sexual forms, ovoids and crescents (gametocytes), develop after a few days of the infection. The staining reaction of all of these forms is quite characteristic:

In a suitably stained preparation (using a chromatin dye) the young parasite appears to be a disk, consisting of a central, pale, unstained area, known as the achromatic zone, and of a basic (blue) periphery, the body, including a metachromatically stained, rounded, compact (red), chromatin mass, the nucleus, which tends to give the parasite the form of a signet ring. Later stages up to a certain number of hours, show simple changes in size and outline of the body. The nucleus then divides by simple mitosis. Later it breaks up by amitotic division into an increasing number of angular pieces. By the time that chromatin division is completed, the angular chromatin masses will have assumed a rounded form, and will be seen to exhibit ultimately the same strong affinity for certain dyes which is seen in the compact chromatin body of the young ring-like form.¹

When the parasite undergoes division the merozoites show, on staining, a chromatin mass with each achromatic body. The best stain is, probably, Leishman's or Wright's modification of Romanowsky's stain (eosinate of oxidized methylene-blue), which is made as follows:

LEISHMAN'S MODIFICATION OF ROMANOWSKY'S METHOD.²

Leishman's method gives good results for general blood work, fixing at the same time as it stains. It has also the advantage that it stains the red blood corpuscles infected by the malarial parasite in a special manner.

Solution A. One per cent medicinal methylene-blue (Grubler) in distilled water; add 0.5 per cent Na_2CO_3 until alkaline.

¹ Park: Pathogenic Bacteria and Protozoa.

² British Medical Journal: Methods of Morbid Histology and Clinical Pathology, Walker Hall and Herxheimer.

Heat to 65° C. in paraffin oven for 12 hours; allow to stand at room temperature 10 days before use.

Solution B. Eosin (extra B. A. Grubler), 1 gm.; distilled water, 1000 cc.

Mix equal volumes of A and B in a large open vessel; allow to stand for 6 to 12 hours, stirring occasionally. Collect the precipitate on a filter, wash with distilled water until the washings become almost colorless, dry and powder the residue. (Grubler now makes this dye, and it may be also obtained in "soloid" form from Burroughs, Welcome & Co.)

To Prepare the Stain.—Dried precipitate (green, metallic lustre), 0.3 gm.; pure methyl alcohol (Merck "for analysis"), 200 cc.

The solution is of a dark-blue color, shows a greenish iridescence by reflected light, and when kept in stoppered glass bottles does not deteriorate.

STAINING.

1. Prepare a thin film. Dry in the air.
 2. Stain with 4 drops of dye for 30 seconds.
 3. Add to the alcoholic stain 6 or 8 drops of distilled water, and allow it to mix with the dye (by rotating the forceps).
 4. Allow the film to stain for 5 minutes (if film is very thick, 10 minutes).
 5. Wash the stain away with distilled water. Allow a few drops of water to rest upon the film for 1 minute.
 6. Dry in air or with blotting paper. Mount in xylol balsam.
- Red.*—Neutrophile, or fine eosinophile granules.
- Ruby Red.*—Nuclei of polymorphonuclear and mononuclear leucocytes.
- Pink.*—Red blood corpuscles. Eosinophile granules.
- Violet to Purple.*—Basophile granules.
- Pale Blue.*—Extra nuclear protoplasm of leucocytes and lymphocytes.
- Blue.*—Plasmodium malarie. Bacteria.

If the red corpuscles appear bluish instead of pink, the pink color may be restored by washing the film in 1:1500 acetic acid solution. Heat may not be used to dry the film, as it breaks up the stain and decolorizes the chromatin.

If a granular deposit is deposited on the films, remove it by washing quickly in absolute alcohol, the film, after a few seconds, being plunged into distilled water to stop the decolorizing effect of the alcohol.

For Schuffner's and Maurer's "dots" stain with the mixture of stain and water for 1 hour, placing the preparation under a watch glass or the lid of a petri dish to check evaporation.

Stain for 10 minutes or longer; wash in water. Dry without using heat.

The most common errors among beginners, in stained specimens, is the mistaking of a fragment of a leucocyte lodged upon a red cell for one of the ring forms of parasite.

Blood Picture.—In the human blood there are only the normal elements with which to confuse malarial parasites; these are, erythrocytes, leucocytes, platelets, products of coagulation and technique. In the fresh specimen, shrunken, spiculated, crenated red cells and shadow corpuscles are often mistaken for parasites. Vacuoles in the red corpuscles, and fragments, often round in shape, adherent to the red cells, are frequently confused with the young hyaline or ring forms; thread-like debris for flagella. Large pigmented leucocytes may be confused with the full-grown pigment bodies of the benign tertian.

Heredity.—The question of heredity has been little considered. Duchek found a large pigmented spleen and pigment in the portal vein in a child dying three hours after birth, born of a malarious mother. Since the discovery of the plasmodium, Bein, Bouzian and Peters found the malarial organism in the blood of new-born infants; probably, however, such infants had had opportunity to become infected since birth. By analogy there seems to be no good reason to controvert the idea of transmission of the malarial parasite through the placental circulation. Germs proper to diseases such as charbon, chicken cholera and septicemia, etc., have been demonstrated in the embryos of animals dead of these respective diseases. The typhoid bacillus was found in the lungs, spleen, kidneys and mesenteric glands of a child five days old, the offspring of a mother who had contracted typhoid fever in the eighth month of pregnancy. Transmission of syphilis is assumed as obtaining through the pla-

cental circulation. Bignami, Bastianelli, Caccini, Thayer and Schaudinn have examined the blood of infants born of malarious mothers and placental blood, and they do not believe the transmission through the placental blood. Though necropsies of several fetuses from infected mothers have negatived the presumption of hereditary malaria, a positive conclusion is still not a violent one.

Susceptibility.—The great liability of the child to get malaria becomes a question of easy solution when mosquito inoculation is accepted. The child is the first to be put to bed and is the first to sleep; the arms and legs and maybe half the body are bare. The skin is delicate and tender, and as compared with the adult, clean, the exhalations from this organ lack the odor emanating from the adult. The adult does not retire until the mosquitoes have filled themselves from the blood of their children; they are better protected by clothing, shoes, etc., and they are better able to avoid the bites of these insects than the infant or small child.

After an entrance into the blood current, the susceptibility is still greater in the infant. The corpuscles upon which the plasmodia feed offer less resistance; more of these bodies are destroyed, comparatively, at each paroxysm, than in the adult; consequently more toxins are liberated.

Pathology.—The benign forms of malaria do not produce many fatalities, and it is the pernicious or malignant type that supply our necropsies. The characteristic chocolate and slate color of some of the tissues and organs of the body, produced by deposition of the peculiar malarial pigment, is found in the subacute and chronic cases. Accumulations of malarial pigment, dead parasites, debris and pavingmenting of infected red cells occur in the vessels of the *brain, stomach, liver, spleen, kidneys* and other organs, producing actual thrombi and necrobiotic areas in some of these organs. When it is considered that one-sixth or even one-third of all the red corpuscles in the body may be destroyed by one single, pernicious paroxysm, it will be understood that the above-named organs may become profoundly affected.

Liver.—The liver cells are thinned; the capillaries are dilated

and replaced by fat drops; a great polycholia is denoted by the filling of the gall bladder; injection of the bile capillaries to their finest rootlets. Necrobiotic changes occupying rather extensive areas are seen. The vessels are filled with pigmented leucocytes, dead parasites, remnants and debris, and blocks of yellowish-black pigment. Kupfer's cells and certain endothelial cells undergo multiplication by karyokinesis. This hepatic tumor has a blackish, leaden appearance, and is soft on section. More or less perilobular fibrosis obtains where there have been repeated infections. There is objection, however, to the idea of portal cirrhosis from malaria alone.

Spleen.—The splenic tumor may be merely palpable below the costal margins, or it may reach below the navel and to the anterior superior spinous process of the ilium. Postmortem, the surface of the spleen is dark, sometimes black; on section the gland tissue is also found to be dark; the parenchyma of the organ is much softened; the tarry pulp may be washed away with quite a gentle stream of water. The pigment of malaria is here found within the endothelium of the arterioles and capillaries in minute grains, often in actual blocks; we find aggregations of pigmented leucocytes, dead and breaking-down parasites forming thrombi and actually occluding the vessels. The spleen and bone marrow have the distinction over all other organs of containing pigment in the cells of the parenchyma outside and away from the blood vessels. In these latter organs pigment is contained in ordinary leucocytes, but in the splenic vein this substance is included, not only in leucocytes, but also in certain large white cells identical with those occurring in the spleen, and evidently of splenic origin.

Kidneys.—The renal changes are not as severe as has been supposed, especially in the milder forms of malaria. Grossly, they are slightly enlarged and pale in color. Small evidence of pigmentation. Microscopically, the glomeruli and the interlobular vessels are seen to contain infected red cells and pigmented leucocytes. In the pernicious forms, and especially the hemoglobinuric form, the kidneys in the early stage of the disease are enlarged and congested; the tubules are blocked with hemoglobin infarcts; the cells are loaded with yellow pig-

ment grains, and the capillaries with black malarial pigment. The appearances are then those of the large, white kidney. The severest cases of nephritis of malarial origin are found in hemoglobinuria. The capillaries in the medulla and papillæ are often filled with infected cells and parasites; while the tubules are filled with casts, in which are, sometimes, entangled infected red cells, parasites and pigmented leucocytes. Ewing reports a case of acute hemorrhagic nephritis of malarial origin.

The Bone Marrow.—Many sexual and pigmented forms and free pigment, pigmented leucocytes and macrophages harbor in the bone marrow. The small capillaries here are frequently choked.

Respiratory Organs.—The bronchitic and bronchopneumonic manifestations are seldom seen in the very young. I have, however, seen several cases, in adults, where there was spitting of blood and other signs of pneumonia, accompanying the paroxysm, and which cleared up with the administration of quinine and the subsidence of the fever.

Symptoms and Clinical Outline.—It is the duty of the physician to carefully instil into the minds of the parents the grave importance of noting the little indispositions, of whatever nature, of the infant in a malarial region. A child does not cry and fret, does not refuse to nurse or eat, does not get nauseated or become restless at night, will not stop play for nothing. The mothers in the bottoms soon learn this. Eternal vigilance here is the price of liberty.

There is no disease which may reach alarming proportions in children so stealthily as that of malaria—yet so surely raises the danger signal, if one has been observant.

We are to look for fretfulness, nausea, vomiting, stomachache, diarrhea, dysentery, epistaxis, excessive or scant urinary flow, drowsiness, fetid breath, coated tongue, headache, backache, feverishness and fever, etc. Any one or most of these symptoms may be present in a mild degree, one day, slightly more severe the next day—the third day (or even the second day) the blood is supersaturated with toxins, the nervous system is overwhelmed, pupillary manifestations appear—one pupil dilated, the other contracted, the extremities are in clonic convulsions,

the jaws are clinched, unconsciousness comes apace. This is the *eclamptic* form, or the condition generally known as "congestion," from which so many babies die in the river bottoms of the South. Indeed, there is a general congestion, the most prominent symptoms may direct in one instance to the brain, in another to the liver, and still another to the stomach. The convulsions may be reflex in their nature, the point of irritation which predetermines the flow of blood to a given organ or part being large accumulations of malarial pigment, dead parasites and debris, often occluding large vessels and lymph spaces. Often one sees families who have had born to them five, six and even ten children, and only one, two or three of these live to cheer and brighten their homes, and in each instance one is told that all of these little ones perished with so-called malarial congestion.

However, not all children suffer with acute malaria; a good percentage of them have chronic malaria, cachexia; one or two mild chills; quinine administered in mild doses just sufficient to prevent the next paroxysm, then given indifferently or not at all. The child goes on with considerable blood destruction, accumulating pigment, bile and malaria, their little skins take on a bronzed appearance, thickened and dry as parchment; soon the spleen fills up and may be felt from 2 inches below the ribs to as low down as the iliac fossa, sometimes reaching across to the opposite side; its pressure upward on the diaphragm, with the pain which is often centered in the upper part of the organ simulates, and the parents are often apprehensive of pneumonia. The liver is more or less to be felt below the costal margins. Sometimes there are black, tarry stools. But more often these are clay colored. There may be constipation, the rule, however, seems to tend towards a looseness of the bowels, the color of the stools in this latter condition is that well known of "milk gravy." The urine is scant and scalding, highly colored and heavily loaded with solids; occasionally there is a flow of clear (water colored) urine. This may be regarded as a manifestation of active malaria, and generally presages a paroxysm, however mild it may be, followed by only a little back or leg pain, the plasmodia may be sought in the peripheral blood. The

tongue is large and flabby, indented by the teeth, with a whitish cast; this, as are also the gums, is pale, anemic.

Moncorvo believes that infants and children so infected are physically, mentally and morally deteriorated. He places malaria beside syphilis and tuberculosis, a retarder of physical growth. Every malarialogist will attest that in the tropics and subtropics in the treatment of any disease, he has a malarial

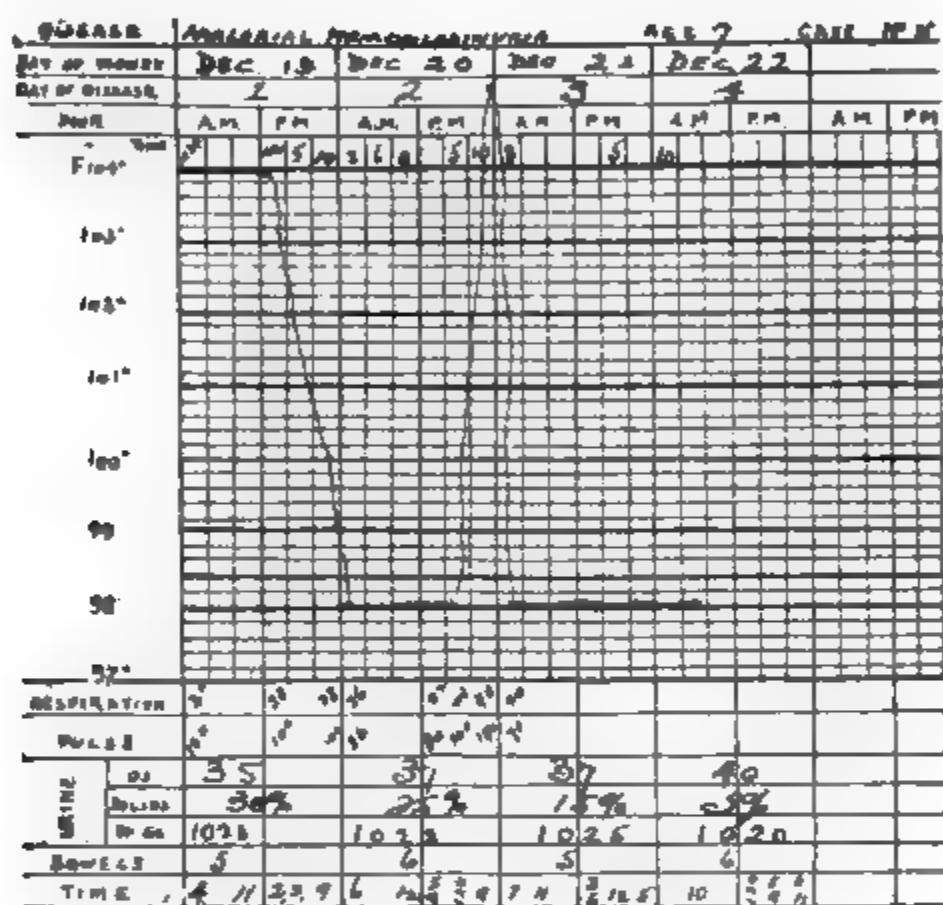


Fig. 69.—Malarial hemoglobinuria.

base to work upon, even in wounds which confine to the bed or room malaria is precipitated. My experience fully accords with that of Moncorvo. It requires no stretch of the imagination to say what three or four generations of these little bronze fellows will bring. It becomes quite a social problem, when our most fertile lands are so poorly habitable on account of this infection.

The *fatality*, according to L. Colin, of pernicious fevers, in an ascending scale is, icterus, comatose, delirious cardialgic, algid and syncopal. As previously stated, the benign forms of malaria do not produce many deaths, and are therefore easily amenable to treatment.

The *hemoglobinuric* form, upon which a great deal has been written, is, probably, only one of the very grave manifestations of pernicious malaria; the discussion of which could not be permitted by the space allotted here.

What is the therapy of malaria? Every one knows how to treat chills and fever. Alas! it is that character of knowledge, sometimes, of which it is said: "A little knowledge is a dangerous thing."

Prophylaxis.—The preventive steps and safeguards may be summed up in the following paragraphs:

1st. Every effort should be made to banish from the blood all plasmodia. Especially should the blood of infants be made malaria free, because anopheles prefer to attack infants on account of a delicate skin. This may be accomplished by the proper and timely administration of quinin.

2d. All dwellings should be disinfected of mosquitoes, screened with close-wire netting, and extra precaution should be taken of placing close-gauze netting over each bed, and tucking it in at the bottom. These bars should be inspected with a good light, before retiring at night, to guard against infected anopheles, having stolen in during the day or left in from the previous night.

3d. All trees and bushes should be cleared away for a large area around each dwelling, weeds and grass should be mowed closely once a week. Puddles and pools should be filled up, or if too large covered with petroleum.

Mosquitoes cannot live in the summer sun, nor propagate without water.

4th. Patients with malarial parasites should be isolated and carefully covered with netting so that anopheles may not feed upon such patients and, becoming infected, inoculate other persons. Blood examinations should be made in all fever cases. The following is a report of a case of hemoglobinuria:

This patient had a chill December 17. Quinin, in No. 2 capsules, was administered every four hours until hemoglobinuria came on.

December 19. At 11.30 a. m. the patient was comparatively comfortable, and slightly drowsy. The urine was dark. A smear of blood was taken and while examining it I was hurriedly summoned. I found the urine the

color of coffee. Both this and the first specimen responded to the guaiac-turpentin test.

The first blood showed plasmodia. A second smear, taken after the urine colored up, showed plasmodia, estivoautumnal parasites in all stages of development, moderate poikilocytosis, a number of lymphocytes, leucocytes greatly increased, polymorphonuclear and mononuclear phagocytosis.

The lips and gums were pale, also the tongue, which is large and flabby, with a thick, white coat, and a tinge of brown over the back part. Icterus notably mild.

At 1.30 p. m. calomel, gr. x, and turpentin, gtt. xx—turpentin in a beaten egg—were administered, to be respectively, until the urine cleared up. Quinin dihydrochlorate, gr. viiss, hypodermatically, was given at 1.30, 5 and 10 p. m., adding strychnin, gr. 1/120, to each injection. At 10 p. m. the urine was still black.

December 20. At 8 a. m. the urine was clearing up nicely. Calomel was replaced by sodium hyposulphite solution, gr. xx, every two hours. Beef juice was ordered, a half teaspoonful every two hours. Quinin bisulphate in hot solution was ordered, gr. x, every four hours.

At 5 p. m. the dihydrochlorate, gr. viiss, was given hypodermically to avoid paroxysm. A tepid bath, containing a little sodium bicarbonate for a cleanser, followed by hot whisky and quinin, was given. Sponge and normal salt enema every four hours.

At 11.30 a. m. the urine was clear; turpentin was discontinued, and at 5 p. m. the condition was practically normal.

At 10 p. m. the urine was quite dark.

The blood contained numerous hyalin bodies, crescents and round bodies; leucocytosis was marked. There were a few lymphocytes; phagocytosis was marked, and there was an abundance of pigment and pigmented leucocytes. Quinin dihydrochlorate, gr. xv, was given in solution. This was vomited and repeated immediately and retained. At midnight the fever was subsiding rapidly, and the urine clearing up slightly. Turpentin, gtt. xv, was given at 10 p. m., and repeated in 2 drop doses every two hours until urine cleared.

December 21. At 8 a. m. the urine was clear, and there was no fever. The blood contained free pigment, pigmented leucocytes and debris, also two old crescents. Quinin bisulph., gr. v, and strychnin nitrate, gr. 1/200, in solution was ordered. Sodium hyposulphite and beef juice to be given every two hours, and a bath and normal salt solution every four hours.

December 22. At 8 a. m. patient was put on tonic and light diet. It will be noted that at 5 p. m., December 20, quinin, gr. viiss, was given hypodermically, yet the paroxysms came on at 10 p. m., at which time quinin, gr. xv, in solution by the mouth was administered and vomited, repeated at once and retained, and cinchonism was profound. This may be evidence of precipitation of the alkaloid by the alkaline tissues.

Treatment.—When quinin for any reason is contraindicated

we are almost entirely without a substitute; this very fortunately does not often occur. Quinin and the other cinchona derivatives exert a specific action on the plasmodia, and all forms of malaria respond to its action, if the case is seen in time. An infant or child should not be allowed to have a second or third chill even of the benign types. Pernicious paroxysms of every variety, icteric, comatose, delirious, algid, eclamptic or syncopal *require heroic treatment, and should be met promptly by large doses of quinin hypodermically.*

The necessity for a good liver arousalment is here very urgent. For the spasms, chloral hydrate or bromide of potash, either or both, may be used; it will be found that these will be often vomited; a hot mustard bath or a hot normal salt enema may be of value.

For cachexia quinin in sufficient doses and tonics for 40 days in connection with tonics.¹

SYPHILIS; LUES.

Syphilis is a communicable disease, in infancy either hereditary or acquired. The latter form, evidenced by the initial lesion, the train of secondary lesions, showing in the mucous membranes and skin, and the tertiary manifestations in the bones, viscera and nervous system.

Another phase which is of interest to pediatricists is that form of syphilis in infancy termed *tarda*, which Fournier states may "manifest itself at any age, from young adult up to old age."

Etiology.—The recent investigations which have conclusively proven the *spirocheta pallida* to be the specific organism of syphilis have cleared up the etiology of this condition. This organism has been isolated and reproduced on the chimpanzee, and it has been found in the tissues of the syphilitic infant.

The question of transmission of the syphilitic virus to the infant has been a moot one in medicine for years. Belief in

¹ *Bibliography.* Thayer, Allbutt and Rolleson, Vol. II, Part 2. Minchin, Allbutt and Rolleson, Vol. II, Part 2. Stephens, Allbutt and Rolleson, Vol. II, Part 2. Ross, Brit. Med. Jour. Stephens, Mannaberg, Nothnagel, Vol. Malaria and Influenza. Deaderick for reprints. Burns, Hemoglobinuria: Mosquito as a Definitive Host in Malaria. Mosquito as a Definitive Host in Malaria—A Further Consideration. Some General Remarks on Malaria: Malaria, Quinin in. Infantile Malaria: Laveran New Sydenham Society, Celli and Craig.

parental infection direct, without infection of the mother, gave rise to Colles' law in 1837, which was as follows:

A new-born child affected with inherited syphilis, even though it may have symptoms in its mouth, never causes ulceration of the breast which it sucks, if it be the mother who suckles it, although continuing capable of infecting a strange nurse.

In the light of modern knowledge of the etiology of syphilis, we know this law to be untenable. While the mother may seem healthy, she has become infected through the medium of the spermatozoa and ovum and is latently syphilitic, the syphilis being so mild in the mother as to escape observation. By means of reactions of Wassermann and Noguchi, which are typical only in the syphilitic, it has been shown conclusively that mothers bearing syphilitic children and showing no lesions are in fact syphilitic.

Mode of Transmission.—The infection of syphilis may be carried to the embryo in the following ways: Direct from the father, through the medium of the spermatozoa, there causing an infection of the mother, which may or may not be recognized. The time of greatest infectious possibility in the father through the spermatozoa is after the primary and acute secondary manifestations. The greatest danger of direct infection of the mother is during the early stages. It is, however, claimed by some authorities that the disease is not transmitted by means of the spermatozoa.

If the father becomes syphilitic after impregnation, infection of the fetus will be through the placenta from the mother direct.

The infection may be from the mother direct, the father being healthy.

If pregnancy is advanced some time in a mother not syphilitic, and she contract syphilis later in pregnancy, the child may be born healthy. The chances of a healthy child being born is in direct relation to the duration of the pregnancy. If both parents are syphilitic before pregnancy, the offspring will be syphilitic.

Treatment of parents after infection makes possible a healthy offspring after such treatment.

A syphilitic woman who has not been intelligently treated,

will give a history of frequent early abortions or miscarriages before midpregnancy, or if progressed to full term will give birth to a syphilitic child.

Pathology.—Syphilitic changes in the placenta are fairly typical. The villi are much hypertrophied, and swollen vessels, some containing thrombi, are in the affected area. There is a fatty degeneration of the epithelial covering. In addition to this the *spirochetæ pallida* have been found in the syphilitic placenta though more often in the stroma and on the villi. The placenta is larger than normal. Nathan Larrier and Brideau¹ claim that spirochetes may be transmitted between maternal and fetal structures, and vice versa, as follows: 1st. A change in structure of the villus and the passage of the parasite through the mediation of perivascular infarcts with or without the intervention of leucocytes, a pathologic process. 2d. Transmission of the treponema by the proliferating cells of Langhans a physiologic process, an important factor because of the ability of the cells of Langhans to penetrate into the vascular system of the decidua.

The *spirocheta* may be found in many of the organs of the infant, the liver, lungs, ovaries, testes, spleen, and in the blood.

The principal changes which take place in the fetus as the result of syphilis occur in the bones, certain of the viscera, the skin and the lymph nodes. In the *bones* there is an inflammation at the site of greatest activity and growth, or a deposit of bony tissue on the shaft of the bone. When this inflammatory deposit occurs in the proximal ends of the phalanges it is termed a *dactylitis*. The long bones are chiefly affected.

The *liver* shows an interstitial change and usually is enlarged. There is a round-cell inflammation in this organ. Gumma may be found. The *spleen* is enlarged and also shows the same increased connective tissue as the liver. The same hyperplasia of connective tissue is found in the *lungs* and *kidneys*. The *lymph nodes* show a round-cell infiltration and enlargement.

The lesions in the *skin* may be of many kinds, erythema, blebs, bullæ, papules, and pustules. The *mucous membranes* may show

¹ Wall: American Journal of Obstetrics, June, 1908.

superficial or deep ulceration. These may be the typical mucous patches.

Symptoms.—A syphilitic child may be prematurely born, macerated and covered with characteristic skin lesions, may be born apparently healthy, with development of symptoms shortly after birth, or present no symptoms for weeks or months after birth, these cases being classed under syphilis tarda.

In the second class of cases the symptoms usually develop during the first six weeks, and may be classed under those affecting the skin, mucous membranes and bones.

The *skin* will usually show a maculopapular syphilide upon the face, neck, hands and feet, and especially about the buttocks. The first skin disturbance may be found about the anus. This eruption may be discrete or confluent. When severe, occasional bullæ or blebs may appear, and if they become infected, pustules appear, which form large crusts or scabs when they coalesce. Condylomata appear about the anus. Blebs and bullæ may be found in relatively large numbers on the palms of the hands and soles of the feet.

Coincident with the skin lesion, sometimes antedating it, a coryza develops, the *snuffles*, which is quite characteristic of the condition. The snuffles is often preceded by an inflammatory condition of the posterior nares with profuse secretion, which is swallowed. The snuffles may be present at birth. There is a tendency for the mucous membrane at the corners of the mouth and at the anal margin to crack. When at the anus especially they are termed *rhagades*. Mucous patches appear upon the buccal mucous membrane at this time also.

An enlargement of the epiphyses quite regularly occurs of the long bones and the phalanges. These swellings may be painful and tender. Dactylitis usually forms, and this may involve the metacarpal and metatarsal bones also. Only one bone may be involved. The parietal and frontal bosses are enlarged, and immediately behind the parietal eminences a thinned and softened bit of bone is found, the typical *craniotabes*. In a lesser number of cases craniotabes may be found in the occipital bone also. Softening and degeneration of the bones of

the nose may occur. The *spleen* is quite regularly enlarged and easily palpable. It is usually much larger than in other morbid conditions. The *lymph nodes* are very generally enlarged. Most frequently the epitrochlea, cervical, axillary and inguinal glands are affected.

The child quickly develops into an anemic, run-down condition. Because of the snuffles its nursing is interfered with and its nutrition is quickly impaired. It is anemic and a condition of athrepsia soon intervenes.

In *syphilis hereditaria tarda*, in which the symptoms may develop at any time from three months to puberty, the triad of symptoms as given by Hutchinson are interstitial keratitis, labyrinthine deafness and deformity of the upper incisor teeth. Corneal opacity is a result of the keratitis. The teeth may be peg shaped or notched, with transverse ridges across them.

Gummata may develop at any place in the body, and not infrequently they appear upon the skin. When in the brain or cord, symptoms referable to these regions develop. *Synovitis* is not infrequent.

Diagnosis.—This should not be difficult in cases born prematurely, presenting the skin lesions and bony changes. *Rickets* may present some symptoms which are suggestive of syphilis, but the diagnosis should not be difficult. Rickets develops, as a rule, later, and the skin symptoms are not present. The bony changes in rickets are usually symmetrical, single joints being affected in syphilis. Later Hutchinson's teeth are confirmatory evidences of syphilis.

Prognosis.—The influence of syphilis upon infant mortality is not generally appreciated. Statistics¹ show a fetal mortality in paternal heredity under most favorable circumstances, of 28 per cent; in maternal heredity, of 67 per cent, 86 per cent and 71 per cent, according to different observers, and in mixed heredity from 68 per cent to 86 per cent. Morrow states that one-third of all children born syphilitic die before they reach the age of six months. Syphilis then becomes one of the most severe of the scourges affecting the infant population. If a

¹ Author's paper: *Syphilis Affecting Infant Mortality*, Journal A. M. A., 1904.

syphilitic infant is breast fed it has a better chance to recover.

Treatment.—If a diagnosis is made of syphilis in either parent, every means should be used to prevent conception.

If pregnancy occurs, by a syphilitic father, in a mother who shows no signs of syphilis, if she is put at once upon an anti-syphilitic treatment, which is conscientiously carried out during gestation, she may give birth to a healthy child. If she gives a history of frequent interruptions of pregnancy before term, from syphilitic causes, she may go to full term and give birth to a healthy child, provided active treatment is undergone during the entire pregnancy. The mother should nurse the child and continue treatment. A wet nurse should not nurse a syphilitic child.

The treatment of a child, the subject of congenital syphilis, should be begun early and be faithfully carried out. It should be continued until the symptoms are decidedly improved and then discontinued for a week, then resumed for a period of three or four weeks. Gradually increase the interval between a course of treatments. The child should be kept under treatment for at least two years, better for three years. Mercury should be used in the early stages and can be given by 1, *the mouth*; 2, *by the skin*, and 3, *subcutaneously*.

In all forms of administration symptoms of saturation should be looked for.

1. By the mouth, the following preparations can be used: *a.* Hydrargyrum cum creta (gray powder), in 1 grain doses, three times a day. The chalk usually controls the laxative effect of the mercury, but if it does not Dover's powder, $\frac{1}{4}$ grain, can be combined for its effect. The dose of gray powder can be increased later. *b.* Calomel, in doses of $\frac{1}{30}$ to $\frac{1}{10}$ of a grain, three times a day. Dover's powder, $\frac{1}{4}$ grain, may also be used with this if it causes diarrhea. *c.* Bichloride of mercury, with sugar of milk, in $\frac{1}{60}$ to $\frac{1}{40}$ grain doses. *d.* Protoiodide of mercury, in dose of $\frac{1}{15}$ to $\frac{1}{10}$ grain.

2. By inunction the following can be used: *a.* Ung. hydrargyri with equal parts of lanolin, a piece the size of the end of the little finger being rubbed twice daily, or about 5 grains of the mercury into the flexures of the body, alternately. *b.*

Oleate of mercury, from 1 to 5 per cent, may be used in the same way, or as suggested by Rotch, saturating the binder with it and allowing it to be worn for 48 hours. Except in hospitals, this method of treatment is very unsatisfactory, and frequently severe dermatitis is caused by the inunctions.

3. By injection, can be given bichloride of mercury in a 2 per cent solution, 4 to 8 minims, every two or three days. This method of treatment is very impractical in children. A general supervision should be had over the feeding, habits and sleep of the patient. Breast milk is the best food, but not from a wet nurse. These children resist infections and illnesses very poorly, hence should receive the best nourishment and be protected from contagions.

The treatment of syphilis in children by Salvarsan (Ehrlich's 606) has received much attention. A word of caution cannot go amiss as to the use of this preparation in children. It has not been used frequently enough for the last word to have been said in regard to it. 0.008 to 0.01 grams per kilogram of body weight has been given as the guide for infantile dosage. It may be given intramuscularly or intravenously.

Treatment of the Special Symptoms.—The catarrhal condition of the nose causing the snuffles requires cleansing washes, Dobell's or Seiler's solution in spray or douche, followed by calomel insufflation or ointment (1 part to 20), or the ung. hydrargyri ammoniati, applied to the cavities. For *fissures* about the mouth and *rhagades* at the anus, dry calomel is of benefit. Diarrhea may need treatment by discontinuance of the mercury and administration of bismuth alone, or combined with Dover's powder.

Potassium iodide is given only when tertiary symptoms develop, hence late in the affection, and this drug pushed to point of saturation.

CHAPTER XVI.

CONTAGIOUS DISEASES.

ACUTE EXANTHEMATA.

MEASLES.

Synonyms.—*Rubeola, morbilli, fleckern, masern.*

Definition.—Acute, eruptive, febrile disease caused by a specific contagion. It is characterized by a period of incubation, a prodromal stage, with catarrhal symptoms and fever, a stage of eruption upon the skin and mucous membrane of the respiratory tract, and a stage of desquamation.

Etiology.—Measles is perhaps the most contagious of the eruptive diseases, though the specific organism which is the cause of it has never been isolated. The organism is shorter lived, evidently, than the organism which causes the other contagious diseases. Occasionally a natural immunity is seen. One attack usually confers immunity although recurrences are not unusual. Children under six months of age are less susceptible than older ones, and adults who have not had the disease in childhood may contract it. The contagious period exists throughout the whole course of the disease, though the early acute catarrhal stage is supposed to be the most contagious.

The contagium in cities rarely entirely dies out. It is very often endemic and frequently epidemic in character. Because of the closer housing of children in winter, and the schools being in session during these months, it is more prevalent in winter than in summer. Apparently it is possible for sporadic cases to develop without being able to trace the infection. It has been stated that the contagium cannot be carried through the medium of the second person or by means of toys, clothing, etc. No milk borne epidemics have been recorded.

The practice which is frequently seen in cities of mothers deliberately exposing their children to the contagium of any of

the exanthemata is one which cannot be too violently denounced.

It occurs more frequently during the first six years of age.

Mason¹ has reported a case of measles in utero. The mother was delivered after a typical attack, during the stage of desquamation, and the child showed a mottling of the skin and profuse general desquamation which persisted for 20 days.

Pathology.—The chief changes are in the mucous membranes and skin. The enanthem, Koplik's spots, are usually present from twenty-four to forty-eight hours before the exanthem. They are bright red spots of infiltration in the mucous membrane of the cheeks and lips. A round-cell infiltration occurs in the skin, especially around the hair follicles and sweat glands. There is an engorgement of the skin capillaries during the eruptive stage. The conjunctivæ are engorged and the natural secretion greatly increased.

Symptoms.—The symptoms are generally divided into three periods, that of *incubation*, *prodrome* or *invasion*, *eruption* and *desquamation*.

Incubation—The duration of the period of incubation is from 8 to 14 days, the eruption usually appearing between the tenth and fourteenth days after exposure. Usually there are no symptoms referable to this period, until 48 to 52 hours before the appearance of the eruption.

The Prodromal Stage or Period of Invasion.—Two or three days. The first symptoms of this stage are usually those caused by the catarrh of the respiratory and conjunctival mucous membranes. These may be preceded by vomiting, slight headache, lassitude, and within a very short time will be seen a coryza and reddening of the eyes, photophobia is pronounced, a harsh throaty cough, perhaps some hoarseness, if the larynx is involved, with more or less bronchitis developing later.

Beginning with the advent of the catarrhal symptoms, there is a rise of temperature, varying from 101° to 104° F., reaching its height with the full appearance of the eruption. There is a slight morning remission of perhaps 1° F., and the rise in the afternoon. There is an increased drowsiness and almost entire loss of appetite.

¹ Boston Medical and Surgical Journal, October, 1908.

Koplik has described a condition which is present upon the mucous membrane of the mouth, from 24 to 48 hours, before the appearance of the eruption upon the skin. This, as described by Koplik, is a bright red spot on the mucous membrane of the cheek and lips, in the center of which is a minute bluish-white

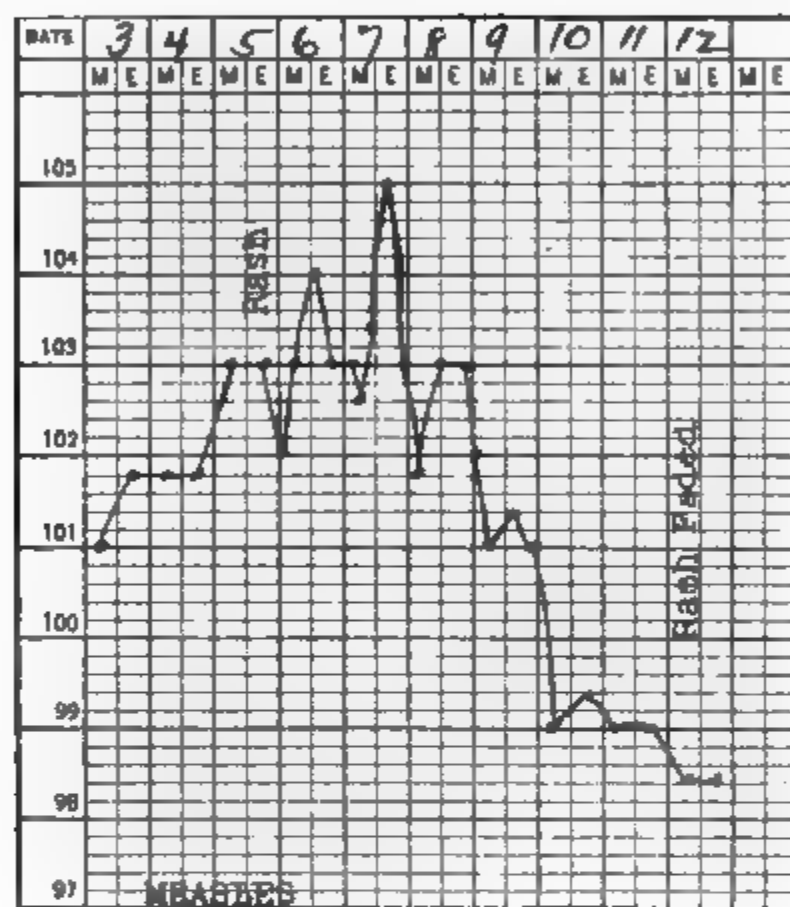


Fig. 70 Measles.

sneak. This enanthem can only be seen in a good light, and the spots are very characteristic when found, and Koplik claims that they are pathognomonic of measles.

Eruption.—This usually appears on the third or fourth day. It is a dusky red, pin-head eruption, usually appearing first upon the sides of the neck and about the margin of the hair, then upon the chest and face, and gradually the whole body is covered. The eruption is much less prominent upon the lower extremities than upon the body and arms. It sometimes becomes confluent. It varies in color and is decidedly more dusky red than the eruption of scarlet fever. The rash may appear crescentic in form but the spots are usually irregular in outline.

In the very severe forms measles is sometimes designated as

black measles, the eruption is of a bluish-black color which is due to the extravasation of blood under the skin. This form is also called malignant measles.

The duration of the eruption upon the skin varies from three to five days. With its disappearance there is left a slight discoloration or mottling of the skin, which may remain for several days.

The eruption fades first from the mucous membranes and from the skin in the order in which it first made its appearance; and if the congestion of the skin has been very intense the *desquamation* begins in small bran-like scales in the same order. This scaling has also been described as furfuraceous. The desquamation is not at all regular, as frequently cases are seen in which no desquamation takes place at all. It is usually proportionate to the amount of temperature and severity of the rash, and continues from four days to a week.

As the rash disappears, all of the symptoms gradually improve, the fever shows a regular decline, the cough improves, there is a slight return of appetite, photophobia disappears, though the eyes may remain weak for some time, and a mild conjunctivitis may also remain.

Atypical Cases.—In an epidemic many varieties of cases are encountered. They may be so mild as to go practically unrecognized, in which the rash is very slight, there is very little fever and few catarrhal symptoms. Frequently, unless these cases occur in an epidemic, they go unrecognized.

Malignant.—This form is decidedly the most fatal and occurs in children with very little resistance. The eruption is very severe, frequently of the hemorrhagic type, ordinarily called black measles. Sometimes the malignant form may have but little rash, and the severe symptoms are caused by the severity of the complications. In this form of cases, pneumonia is the principal complication and the cause of the majority of the fatalities. In this the rash not infrequently disappears more or less rapidly. The laity look upon this condition as “striking in” of the rash, considering it the cause of the complication. This phenomenon is a result of the complication and not the cause.

Complications and Sequelæ.—The chief complications are those of the respiratory tract; bronchitis and bronchopneumonia. The younger the child, the more liable it is to develop pneumonia, and it is the most frequent cause of death. This complication

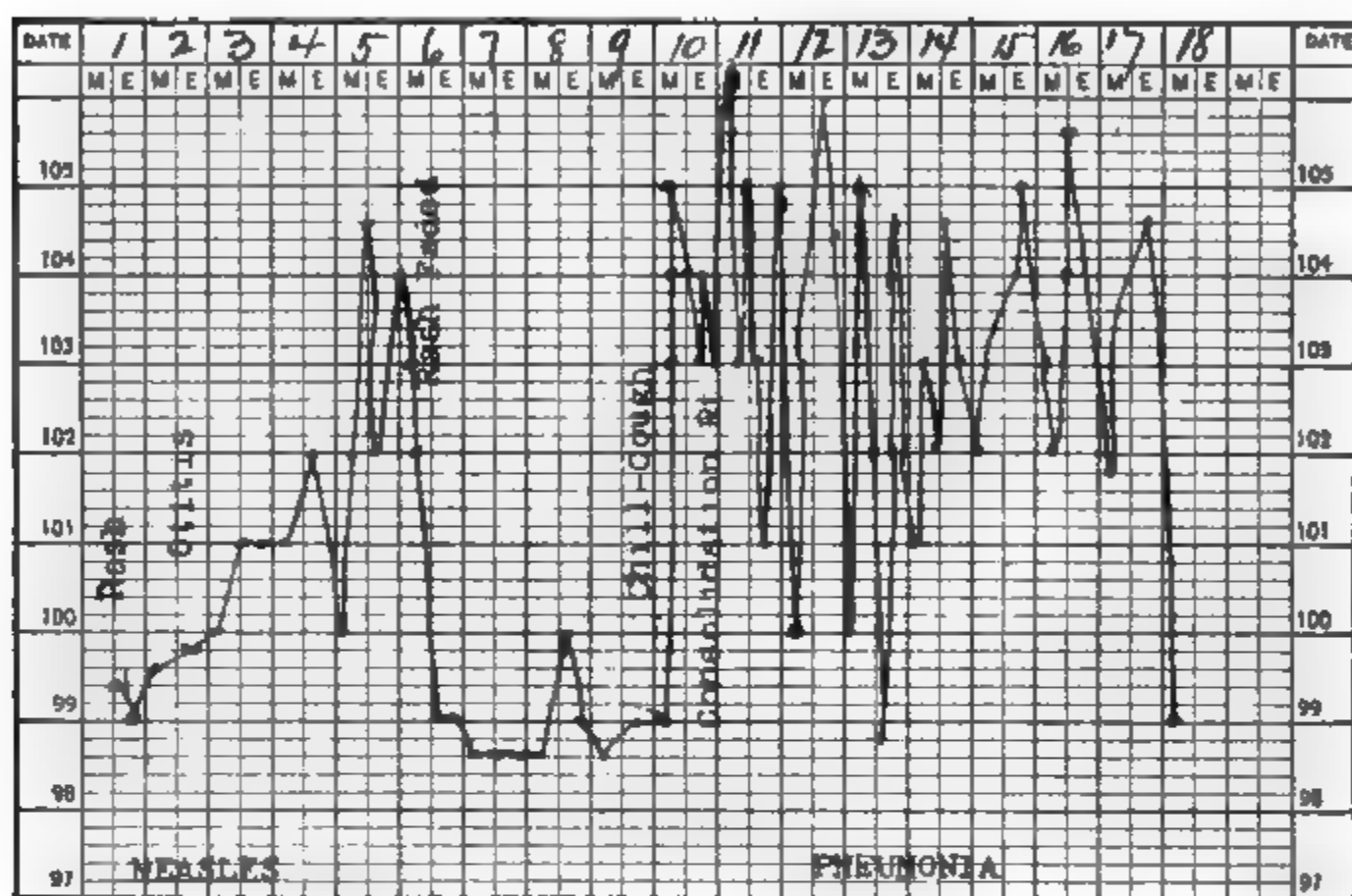


Fig. 71.—Measles with complicating pneumonia.

is due to invasion of the respiratory mucous membranes by the pneumococcus and the streptococcus, and in practically every fatal case of measles, more or less *bronchopneumonia* will be found.

Catarrhal *laryngitis* and *pharyngitis* are very often present, and in these cases in which this is a feature an invasion of the *middle ear* is more often present. Spasmodic croup has been reported as a complication. *Otitis media* is a frequent complication. It has not been my experience to see many cases of pseudomembrane upon the tonsils or pharynx in measles, though it has been frequently recorded by various authors. A cellulitis of the skin of the external auditory canal may occur. *Conjunctivitis* is a very frequent complication. There is always a congestion of the conjunctiva and this may persist especially in

poorly-nourished children for some time after the disappearance of the rash.

Tuberculosis.—Because of the catarrhal condition and adenitis resulting from measles, the soil is ripe for the absorption of the tubercle bacilli and their development. The frequent occurrence of bronchopneumonia also offers a site for their development and propagation. The tubercular process may have been latent and an attack of measles all that was needed for its lighting up.

Cutaneous Complications.—A general pruritic condition of the skin may be present in measles, especially during the early eruptive stage. This may be partly due to a *sudamina*, or blocking of the sweat glands, and consequent formation of minute vesicles and great itching. *Herpes labialis* and *facialis* is frequently seen, and *urticaria* is also a complication. This may take the form of the large wheals or the minute papules which itch greatly. In the grave or hemorrhagic form *noma* may develop, due to an infective embolus finding lodgment in the cheek or perhaps an extension from an ulcerative stomatitis.

Prognosis.—This depends to a great extent on the individual child, on the character of the epidemic or endemic, the age of the child and the complications. The mortality from measles itself is not very high. The occurrence of pneumonia or any bronchial irritation renders the prognosis much less favorable. This one complication is the cause of the largest percentage of deaths in measles.

The early evidence of toxemia makes the prognosis less favorable.

The uncomplicated form of measles in a child over four is usually not very severe.

Prognosis is bad in cases with such complications as laryngitis, otitis, diphtheria, hemorrhages in the skin.

Diagnosis.—With the first description of the *buccal eruption* in measles by Koplik, the diagnosis became much more easily made, for in connection with the catarrhal symptoms present the diagnosis can be made even before the rash has appeared.

Rubella is apt to be confounded with measles, as the rash is very similar indeed. In this condition, however, all the symp-

toms are less severe, little or no fever, very slight catarrhal symptoms, the rash appears more quickly and remains out a shorter time, and desquamation is rarely seen. The post cervical adenitis, is a characteristic sign in rubella and not a constant one in measles.

Scarlet fever is less apt to be confused as the rash is so entirely different. There are but few if any catarrhal symptoms or cough in the early stages. The scarlatinal throat and tongue are not present in measles.

Drug eruptions and the eruption due to an intestinal toxemia, the so-called "stomach rash," may cause some confusion in diagnosis. Rashes occur from the administration of antipyrin, quinin and chloral and the antitoxin sera. In all of these the catarrhal symptoms are absent, usually but little fever, and not suggestive of measles in its range.

Treatment. *Prophylaxis.*—As already stated, there is a widespread belief indulged in that all children should have the contagious diseases, unfortunately, by some physicians, and too many cities having the contagious disease placard system omit measles from the list of diseases to be reported and placarded.

This lack of concern results in lax efforts at isolation and many unnecessary cases and deaths occur.

Strict quarantine should be maintained and the child isolated as soon as a history of definite exposure has become known. Then when it is ready to be relieved of quarantine, when desquamation has ceased, and no catarrhal symptoms persist, the final cleansing bath and room preparation should be insisted upon. Quarantine should be maintained at least three weeks.

Uncomplicated measles is a more or less self-limited disease. The *curative measures* will therefore be largely directed toward the prevention of complications. Hence, to prevent pulmonary involvement, the child must be kept in bed in a large, airy room, with plenty of fresh air. The light must not shine direct in the eyes, but there is no necessity of keeping the room entirely dark. The head of the bed should be turned toward the light and covered with a sheet to keep out the bright light.

The eyes should be bathed at least twice a day with a warm ten per cent solution of boracic acid. The nose should be

sprayed or irrigated with the same solution or with a normal salt solution.

Fresh air should be insisted upon. The child should be protected with sufficient clothing and outside fresh air let in.

The harsh, dry cough which is apt to keep the child awake should be controlled. Moist air, obtained by keeping a steam spray going in the room near the bed by a croup kettle or steam atomizer is of great assistance to this end. To the water can be added tinct. benzoin comp. (3i to Oi) or oil of eucalyptus (3ss to Oi), both of which, in connection with the moist air, have a sedative action on the mucous membrane of the throat and larynx. Codeine in $\frac{1}{8}$ to $\frac{1}{4}$ gr. doses, plain or with a teaspoonful of brown mixture, can be used with great benefit for the cough. Wet, cold compresses to the throat, protected by a dry flannel, wider than the wet one, and changed every four to six hours, will be found of service also.

If, during the early eruptive stage, there is great restlessness, 3 to 5 grain doses of potassium or strontium bromide can be given at three-hour intervals, or small doses of phenacetine.

Unless there is hyperpyrexia the fever needs no attention. If it remains persistently above 103° F. it is best controlled by full-tub baths, wet pack or sponge baths. It is not advisable to give coal-tar products in any form. Enemas, when needed for acute constipation, should be given cool (70° to 80° F.) in the presence of high temperature.

In those cases in which the eruption is slow in appearing a warm bath (100° F.) will be found of service. It quiets restlessness and favors the appearance of the rash.

In measles, as in the other exanthemata, keeping the child wrapped up too warmly in a hot, unventilated room, and the withholding of cool drinks and giving hot or warm solutions in order to "bring out the rash" should not be tolerated.

While nephritis is an unusual complication in measles, it can occur upon exposure, and during convalescence the child should be protected from undue exposure to cold draughts.

Bronchopneumonia is evidenced by a sharp rise in the temperature and an increase in pulse and respiration ratio and evidence of prostration. The treatment of this complication

does not differ from a bronchopneumonia occurring primarily.

Iron and cod liver oil are indicated in the convalescence, especially when a bronchial irritation and anemia persist.

During the stage of desquamation the child should have a daily bath, in a tub if possible, and after drying should receive a general anointing with an unguent, a 1 per cent carbolic acid in vaseline. This is useful to allay itching and as an antiseptic also.

GERMAN MEASLES.

Synonyms.—*Rotheln, Rubella.*

This is an acute specific, infectious, eruptive disease usually of mild nature, and of shorter duration than the other exanthemata, and not at all related to them. It does not protect the individual from any of the other exanthemata. It is characterized by a period of incubation, a prodromal stage, followed by an eruption.

Etiology.—The bacteriology of this disease is not known. It may be sporadic but is usually epidemic, and may occur at any age. It is more frequent in children from two to five years of age. I have seen an epidemic of rubella and rubeola in an institution at the same time. A child would have an attack of one form, and in a few days return with a typical attack of the other. In some cases German measles preceded; in others measles.

Symptoms.—The period of *incubation* is more variable than in the other exanthemata. The average is about 15 days, varying from 5 to 18 days. There are, as a rule, no symptoms during this stage.

During the stage of invasion, which may last from a few hours to two or three days, the child may be restless and peevish, complain of headache and sore throat, evidence some catarrhal symptoms, lacrimation and cough, but these latter are by no means constant. As a rule there is from 1° F. to 2° F. rise in temperature during this stage, the fever being higher as soon as the rash appears, gradually subsiding when the rash is pronounced. Stage of *eruption* begins with the appearance of the rash on the face and neck, soon spreading to the trunk and arms, and finally very sparsely, as a rule, upon the legs, the rash

reaching its height within 36 hours. By the time the rash appears upon the legs it has begun to fade on the face and neck. It is not unusual for the rash to have entirely disappeared within 48 hours from its onset.

The rash appears as a faint red macule, slightly larger than

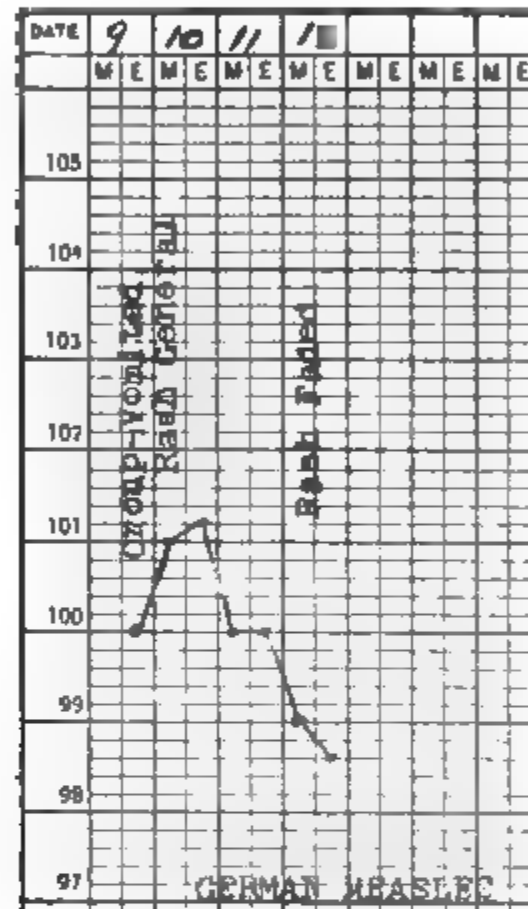


Fig. 72.—German measles.

a pin head, and becomes a rose-red in color. There are areas of normal skin between the macular spots, unless the eruption becomes confluent, which is unusual.

This is the variety of rubella which is usually referred to as the *measles* variety.

The other variety is described as the *scarlatinaform* variety, the exanthem resembling that seen in scarlet fever. The difference between the two forms of rubella are simply in the character of the rash. In the *scarlatinaform* variety the rash is much more widely distributed, does not occur in such large macular spots, and the skin has a more uniform redness.

The mucous membrane of the mouth and throat is reddened but there are no Koplik's spots.

In rubella there is almost constantly found an adenitis, the lymph nodes most frequently found enlarged being those of the neck, both back and front. This symptom occurs in fully 90 per cent of cases, and is a valuable diagnostic sign, as an adenitis is not nearly so frequent in the other varieties of exanthemata. The swelling of these glands quickly subsides after the fever and rash disappear.

Desquamation in rubella is not as regularly seen as in measles and scarlatina. Like in measles, the amount of the desquamation is proportionate to the severity of the eruption, and is bran-like and scaly, and is not prolonged, rarely lasting more than a week. The desquamation may be simply a roughening of the skin and not at all decided.

Complications and Sequelæ.—These are very infrequent and rarely severe. A gland or group of glands may break down and require lancing to evacuate the pus. Stomatitis is sometimes seen, but is never of the gangrenous type; pneumonia is much less frequent than in measles; otitis media may occur.

Diagnosis.—This is frequently very difficult indeed. It must be made from measles, scarlet fever and vaccinia. When it is remembered that rubella is most apt to occur in epidemics, all its symptoms are less severe, rash not so profuse and more discrete; less fever; adenitis present in almost every case and has few complications or sequelæ, the diagnosis is usually easy.

Prognosis.—This is almost universally good, especially so where the hygienic conditions are all right.

Treatment.—But little treatment is required, confinement to bed during the eruptive stage, and while the fever lasts, in a properly ventilated and heated room; cleansing sprays and washes for nose and throat, attention to bowels; bathing, both for cleansing and antipyretic purposes, and anointing during the stage of desquamation.

SCARLATINA.

Synonym.—*Scarlet fever, scharlach.*

Definition.—An acute, specific, highly contagious and infectious, eruptive, febrile disease.

Etiology.—The specific organism, the cause of scarlet fever,

has not yet been isolated, but it is unquestionably due to an organism, and associated with it is the streptococcus in a large percentage of cases. It is the streptococcus which is the cause of so many of the complications of scarlet fever, and it is probably the mixed infection which is present that accounts for the severity of so many cases.

The contagium lives for a long period of time, and can be carried great distances by articles handled by the sick child. A number of epidemics of scarlet fever have been traced to milk as the carrier of the infection, and in every epidemic the milk supply should be closely investigated.

Scarlet fever is most frequent between one and five years of age, though cases are on record in children much younger. It is rare before the sixth month.

A natural immunity may exist. Second attacks are not uncommon. Adults are less susceptible than children.

The discharges from the nose, mouth, throat and bronchi are most virulent as carriers of the contagium, the desquamated skin being also a disseminator of it. Hence, scarlatina is contagious throughout all its course. The port of entry of the contagium is most likely the nasopharynx.

As in measles, because of the close housing and crowded school rooms, during winter, more cases occur in this season than during the summer months. I have never seen a case of scarlatina in a negro, and I believe it is very uncommon in this race.

In spite of the long life of the contagium, scarlatina is not nearly so prevalent as measles. I have frequently seen one case of scarlatina removed from a dormitory of children without the second case developing, while in epidemics of measles practically all the children would be attacked.

The mucous discharges from the nose and mouth and the desquamated skin are the chief sources of contagion. Hence, anything handled by the patient, especially during the stage of desquamation should be carefully disinfected or destroyed. The bedding from the child's bed, the clothes and night dress should be most carefully disinfected.

Symptoms. *Period of Incubation.*—This is usually shorter than the other eruptive diseases, lasting from a few hours to

6 to 10 days. The onset of the *stage of invasion* is short and sudden, it appearing to attack a child apparently well. It is attended by sore throat, vomiting, rigors, fever, rapid pulse, headache, and loss of appetite. Infrequently convulsions may usher in an attack in younger children.

The *tongue* is covered quite heavily with a grayish-white coat, with a cleaning off of the edges at the beginning of the stage of eruption. About this time also the red papillæ begin to show through this coat, which at the tip becomes quite thin, giving to the tongue the appearance of a strawberry. This is considered a confirmatory sign of scarlet fever. About the fourth day of the rash the tongue is clean and papillæ quite prominent. At this time the tonsils are swollen and red; perhaps a slight exudate may have appeared on one or both.

Stage of Eruption.—The eruption appears usually within 24 hours after the first symptom, which as a rule is the vomiting, is noted. It comes out on the neck first, and about the same time spreads to the chest and faintly on the face, and shortly afterward the entire body is covered. It is more distinct on the flexor surfaces of the extremities than the extensors. The flexor surfaces of the joints may not present the typical rash.

The scarlatinal rash is a minute punctate elevation on the skin, with areas of normal skin between, but the skin has the appearance of having a uniformly dull red hue when viewed at some distance. This is due to the erythematous background. The skin is blanched on pressure, the dull red color promptly appearing on removal of this. There may be large areas of normal skin, and the rash looks patchy. It is impossible to make a diagnosis of this rash except in a good light. Frequently minute vesicles may be seen. Itching is often present.

The rash disappears first from the parts of the body where it first appeared, leaving the skin rough, and this is followed by a general desquamation. The eruption lasts from three to seven days, but undoubtedly cases are encountered in which the rash is so slight as to go entirely unnoticed.

I have had such a case under observation. The prominent symptom was the gangrenous tonsillitis, and the boy was treated for this entirely. About 10 days later, after being dismissed

with all symptoms in the throat absent, he consulted me again to ask why his hands were peeling, and exhibited a hand which had the typical scarlatinal desquamation, the skin coming off in large scales.

Desquamation.—This begins upon the parts where the rash first appeared. On the body the peeling is furfuraceous, the skin coming off in larger scales than in measles. These scales are perforated and they have been referred to as “pin-holing.”

Desquamation begins with the subsidence of the fever. The typical scarlatinal desquamation begins upon the hands and feet soon afterward. Cases have been reported where entire casts of the hands and feet were thrown off. It begins at the free border of the nails. This form is referred to as a *lamellosa*. The finger nails show characteristic signs in this stage. If the skin at the matrix margin of the nail is pushed back a cracked line is noted extending up to the matrix. This is best seen on the thumb. No desquamation whatever may follow an unquestioned case. The appearance of the finger nails during desquamation has been described as characteristic. In the sub-ungual spaces with the finger tips pushed back, is seen a cracked line extending to the fingers.

The duration of desquamation is from two to ten weeks, the average being about five weeks.

Fever.—There is no typical temperature curve in this disease, but it is high in proportion to the streptococcic involvement and reaches its height by the second or third day. If everything is progressing favorably the temperature begins to fall with the recession of the rash, and it rises with the development of any complications.

The *pulse* is almost always rapid, out of proportion to the temperature and respiration ratio. There is a general enlargement of the superficial *lymph nodes*, not limited as the enlargement is in German measles to the cervical region, but appearing in the groin, and axilla also.

The *throat* is congested from the rash on the mucous membranes quite early, and an exudate is very often seen after the second or third day, principally upon the tonsils, but it may extend to the uvula and posterior pharyngeal wall. These exudates

may be due to the streptococci or to the diphtheria bacillus, and a culture is generally necessary to decide to which organisms it is due, these cases being known as the *original* form.

The *urine* should be regularly examined during scarlatina. During the height of the eruption the quantity is reduced, but at the end of the first week it returns to normal. It is not uncommon for albumin to be present throughout the disease in small quantities and sometimes the renal derivatives, epithelium, blood, granular and hyaline casts, but they are found more frequently during the stage of desquamation. An acute Bright's disease is not regularly seen, but it does occur as a complication very frequently.

The *blood* shows a diminished number of red blood cells and a leucocytosis is present both before the rash appears and throughout the entire course of the disease. In the anginal form this sign is more marked. There is an increase in the polynuclears and the eosinophiles are absent.

Complications. *Otitis*.—A purulent inflammation of the middle ear is one of the commonest complications. It may occur in cases in which there is no tonsillar exudate, and a spontaneous rupture of the drum is nearly always the result. Scarlatinal otitis is one of the most frequent causes of deafness, and is a complication to be dreaded. Its presence is usually indicated by deafness, earache and rise in temperature, followed soon after by a spontaneous rupture of the drum. The presence of the pus in the auditory canal or the staining of the pillow noticed when the child awakens may be the first evidence of this trouble. Frequent examinations of the ear drums are important, and a paracentesis done as soon as a bulging is noted.

Angina.—This may be either a severe congestion of the mucous membrane of the throat, a severe tonsillitis with enlargement of the tonsils, a pharyngitis and laryngitis, or a gangrenous condition of the tonsils. It is not infrequent that *scarlatina sine exanthemata* is at first diagnosed as a simple catarrhal or a follicular tonsillitis, as an exudate in the tonsillar crypts is very frequent. Where the exudate is very thick, late in the eruptive stage, the chief organism is the diphtheria bacillus. The diphtheritic form usually reaches its height at the end of the first

week, and the symptoms and appearance of the throat are the same as in uncomplicated diphtheria.

Adenitis.—The inflammation of the lymph nodes may be quite severe and suppuration may occur. This enlargement of the glands at the angle of the jaw and of the neck may be enough to cause pressure on the larynx and dyspnea, or the streptococcic invasion of the cellular tissue of throat and larynx, sufficient to necessitate intubation. I have had such a case under my observation.

The child had a severe scarlatina with first a double suppurative otitis media, then an albuminuria, followed by a membranous angina and an obstructive laryngitis. This condition necessitated an intubation which relieved the symptoms for a time only, the obstruction from cellular infiltration both above and below the tube being so great as to make the removal of the tube imperative. This was done with great difficulty. Dyspnea being decided and relief necessary to prolong life, tracheotomy was done. A bronchopneumonia developed shortly after and death from heart failure relieved the sufferings of the child.

Arthritis.—A streptococcic inflammation of the joints is sometimes seen, formerly diagnosed as a scarlatinal rheumatism. It is a synovitis of streptococcic origin. Surgery may be found necessary where purulent effusion in the joint is present. Fixation of the joint is imperative.

Kidneys.—The kidneys are involved in scarlatina in a large percentage of cases, the symptoms appearing usually from the end of the second to the middle of the fourth week of the disease. A diminution in the quantity of the urine, edema of the eyelids, face and ankles is noted, and an examination of the urine shows all the abnormalities found in the urine of an acute nephritis. Uremia may occur in the severer forms of nephritis.

Frequent or daily examination of the urine from the beginning of the second week is desirable, as albumin will often be present before symptoms of the nephritis appear.

Lungs.—A bronchitis is not as frequent a complication in scarlatina as in measles, but it sometimes occurs. Bronchopneumonia is more often seen, especially in those cases in which the streptococci are present in large numbers.

Other complications occasionally occurring are an *endo-*

carditis, in those cases of streptococcic synovitis especially; a *myocarditis* in severe septic infection, as in gangrenous stomatitis; *meningitis* in the course of the disease or following a *mastoid* involvement as a complication of otitis media; *convulsions*, either as an initial symptom or during the course of the disease; an irritable condition of the stomach, recurrent *vomiting*, *anorexia*, *diarrhea*. Vomiting as the first symptom, occurs quite regularly. As *sequelæ* there may be a chronic tonsillitis with enlargement, and perhaps the development of adenoids; deafness, already referred to; mastoiditis; chronic nephritis; and endocarditis.

Diagnosis.—In the irregular forms of scarlatina with but little rash, which is of very short duration, the diagnosis may be very uncertain, as in the case of gangrenous tonsillitis referred to, or not suspected at all, and not made until desquamation begins.

Diagnosis must be made from *erythematous* rashes, either caused by external irritants or from the action of certain drugs or poisons taken internally. Belladonna, quinin, salicylic acid, bromides, or veronal are among the drugs causing rashes. In these rashes there are practically no symptoms except the rash. Scarlatinaform rashes may follow the injection of the serums especially *diphtheria* antitoxin.

The typical cases, however, should be easy of diagnosis. The associated symptoms are characteristic, vomiting, fever, typical rash, sore throat and strawberry tongue.

Prognosis.—In uncomplicated cases this is good. Holt gives the general mortality from 12 per cent to 14 per cent in uncomplicated cases, and cases under five years from 20 to 30 per cent, others give the mortality in several epidemics as 3 per cent. Hence, the prognosis is greatly influenced by the occurrence of complications and by the age of the patient.

Treatment.—*Prophylaxis.* Empirically we have learned that scarlatina is much less contagious than measles, and that the contagium is very much longer lived, hence the special indications are strict isolation and quarantine of every case of scarlatina, and most thorough disinfection after dismissal of the case, of room, bedding, dishes, clothing, etc. Isolation should begin

as soon as it is known the child has been exposed to scarlatina, even though the exposure has been during the incubation stage, when it is believed the least danger is present. Other children in the house should remain away from school, and should not be sent away from home in order to continue at school because of the possibility of late development of scarlatina in them. All intercourse between the sick room and the rest of the house should be prevented, and the physician should protect himself by a long gown before entering the room and cover head with head gauze or cap. The gown should be taken off after leaving the room. The hands and face should be then carefully washed.

Quarantine should be prolonged during the entire stage of desquamation, and not until the feet and hands are entirely free from roughness and scales should it be raised. The persistence of the discharge from an otitis or a chronic nasal discharge or pharyngitis is sufficient ground for maintaining the quarantine.

Placarding of houses is most important and this regulation will be made a law if the physicians of a community demand it. The medical inspection of public school children is a measure which will prevent many epidemics of scarlatina and measles, as the early recognition of the sore throat of one, catarrhal symptoms and buccal eruption of the other, will be enough to remove the child from the class long enough to have the tentative diagnosis confirmed or disproved. Attention to details in the choice and conduct of the sick room should be given by the physician. A room as cheerful as possible should be chosen, but removed from the rest of the house, on the top floor, or at the back, near enough to the toilet and bathroom as not to necessitate the carrying through all the halls of the discharges, etc. All unnecessary hangings and the carpet should be removed. A tub should be provided in the room containing enough antiseptic solution (1:2000 bichloride or 1:20 carbolic acid solution), in which all bed linen and clothes can be soaked before they are removed to be washed. They should then be boiled separately from the rest of the wash. Scraps of old sheets or tablecloths or squares of gauze are best used for handkerchiefs, and burned afterward.

A sheet should be hung from the top of the door frame out-

side the door to lessen air communication with the rest of the house.

After desquamation has begun general inunction of the skin is of service in preventing the dissemination of the scales. Plain vaseline is as good as anything as it is doubtful if any antiseptic of sufficient strength to be bactericidal will not be strong enough to cause the irritation of the skin; 2 per cent of carbolic acid can be added if there is much itching, but it must not be used very strong.

Toys and books should be destroyed after the child has been removed from quarantine.

The room should be carefully fumigated and the walls and woodwork wiped down with a 1:1000 solution of bichloride of mercury or 1:20 solution of carbolic acid.

Symptomatic Treatment.—As there is no specific for scarlet fever the treatment is largely symptomatic.

Fever.—For hyperpyrexia coal-tar products should not be used but hydrotherapy employed without any hesitation. The sponge bath or wet-sheet pack can be used without trouble, and in spite of remonstrance from the family. During the bath at a temperature of 85° F. or 90° F., the circulation should be watched, especially of the hands and feet, and hot-water bags applied to them if they are persistently cold. A continuous temperature of 103.5° F. usually requires attention, but the effect of the temperature on the patient should be the guide. Gentle friction of the skin should be used while the bath is being given. A little alcohol in the water for sponge bath is advantageous. It is well, with a tendency for the temperature to run high, to place an ice bag to the head, which usually materially assists in the control of the fever.

Kidneys.—Water should be given at very frequent intervals from the onset of the symptoms in order to keep the kidneys flushed. This is especially so in the cases with severe angina when the mixed infection is apt to be a feature. The following is of benefit:

R	Liq. ammonii acetatis	℥ss
	Spiritus ætheris comp.	℥i
	Aquæ destillat.	q. s. ℥iv
M.	Sig. One teaspoonful every 3 hours.	

Bowels.—If the vomiting is not persistent, an initial dose of calomel of 1 to 3 grains is of great benefit and should be given as soon as possible. If not effectual in obtaining a free evacuation it should be followed by 2 or 3 drachms of castor oil. Daily evacuations, which must be insisted upon, can probably be obtained by using an enema or glycerine suppository. An occasional drachm-dose of cascara aromatic, or syrup of tamarinds or milk of magnesia may be needed during the bed stage.

Owing to the great amount of extra work thrown upon the kidneys, the diet should be such as will not increase elimination by the kidneys, hence a milk diet is decidedly the best. A mixed diet, with no meat, can be begun after complete subsidence of the fever and rash.

A very good rule to follow is to keep the child in bed for one week after the disappearance of the rash, and then to let it get out of bed for a gradually increasing time each day, being well protected from exposure if not entirely dressed.

Nose, Throat and Ears.—Antiseptic spray, Dobell's solution, normal salt and boracic acid solution in equal parts, warmed to 110° F., can be used as either a spray, douche or snuffed up the nose, in cases with profuse nasal discharge, or used as an irrigation in angina. The danger of forcing fluids through the Eustachian tube into the middle ear and causing an infection should be remembered. Nasal irrigation with fountain syringe is recommended in smaller children.

Regular, four-hour interval irrigation of the *middle ear* when the drum has ruptured with warm boracic acid solution should be carefully done, the ear dried, and powdered boracic acid insufflated into the middle ear. Paracentesis of the drum should be done if an examination of it shows it to be bulging, in order to obtain free and prompt drainage. This should be done under a general anesthetic always, as the shock to the child from the pain and being held is too great to have it done without. Gas anesthesia is quick and safe and is recommended.

Soreness of the throat is a prominent symptom at the onset, and cold applications are very serviceable. A small, wet flannel is folded and placed next the throat and covered with a wider, dry piece of goods. Crushed ice fed to the patient is sometimes

found to be grateful to the throat. The tendency to adenitis may be largely controlled by the cold, wet pack.

For the *nervousness* and *restlessness* which is often a decided feature in the early stages of the eruption, the following can be safely used in a child of five years:

R Strontii bromidi	3iii
Chloralis	3iss
Syr. limonis	3i
Aquæ destillat.	q. s. 3iii
M. ft. sol.	

Sig. One teaspoonful every 3 hours as needed.

Heart.—The circulation should be watched closely. The tendency is to have a much-increased pulse rate and the first evidence of flagging in its quality should be met by the administration of strychnia, whisky and probably by digitalis. Digitalis can be given in the fat-free tincture, in 5 drop doses. If whisky is used, only an article of known value, or one which has been bottled in bond, should be used. Strychnia can be given in 1/150 grain doses, and if used for some time the child watched carefully for twitchings which may develop if it is used too long.

During convalescence iron is indicated in some form, and if there is an indication of kidney involvement, Basham's mixture is serviceable, in 1/2 to 1 teaspoonful doses, well diluted, three or four times a day.

Severe adenitis is best treated by the application of ice cloths or an ice bag. No virtue can be found in the so-called mud preparations, and only great discomfort is given the patient when they are applied.

Too much emphasis cannot be laid upon the importance of fresh air throughout the entire course of the disease. Protect the bed from draughts, plenty of coverings, and keep the windows open, an open fireplace is to be preferred greatly to a gas fire, closed stove or furnace heat.

The *serum* treatment has been recommended, antistreptococcic serum as a routine and the antidiphtheritic serum in the true diphtheritic anginal cases.

VARICELLA.

Synonym.—*Chicken-pox.*

Definition.—A specific, infectious and contagious eruptive disease common to childhood. It is characterized by a rash which appears as a maculopapule, followed by a vesicle, the latter drying and falling off as an encrustation or scab.

Etiology.—The specific organism has not been isolated, but it is highly contagious and can be carried by a third person. It is contagious throughout the eruptive stage, the scales being capable of transmitting it. Age is an important factor. It occurs chiefly in children under 10 years of age, being rarely seen in adults. It has no relation to small-pox and one does not protect from the other.

Symptoms.—Period of *incubation, invasion or prodrome, eruption and desquamation.*

The *incubation* period is from 10 to 16 days, the average period being about 12 days. There are no symptoms common to this period.

Invasion.—There are few prodromal symptoms, in the majority of cases the rash being the first symptom. Frequently the child may be quite restless during the night and may itself call attention to the rash when dressing in the morning. There is apt to be a slight rise in temperature. Digestive disturbances are rare, though there may be vomiting.

Eruption.—The first spots noticed are usually upon the chest, and the margin of the hair and face. If seen early the rash will appear as a reddish blotch, followed soon by a papule, upon the apex of this appearing a tiny vesicle which gradually enlarges in size. The rash rapidly spreads to other parts of the body, appearing in successive crops for 48 hours, so that at the end of this period there are present all stages of the eruption at the same time. The papule usually is about one-fourth of an inch in diameter, the vesicle being slightly smaller, having the appearance of resting upon a red base. Occasionally the vesicle will develop upon the skin without the primary macule or papule, looking like a drop of water on the skin. The fluid of the vesicle at first is clear, but in a few hours it is cloudy in color. The vesicle is unilocular and when pricked upon the top

the fluid escapes. Infrequently the vesicles are umbilicated, in this respect resembling the small-pox vesicle. As the vesicle dries the scab forms. Sometimes the vesicle becomes infected and a good deal of cellular infiltration may occur, with ulceration into the true skin, and resulting pitting scar. Coincident with the appearance of the exanthem, the enanthem appears on the mucous surfaces, the mouth, vulva and prepuce.

The eruptive stage lasts from three to four days, when all the spots are usually scabbed over, the scabs becoming separated in from two to three weeks.

Systemic Symptoms.—The temperature rises, though it is exceptional to find it very high. It does not run a regular course, and is rarely over 102.5° to 103° F. During the fever the papular and vesicular stages, the child is restless and peevish, complains frequently of itching and burning, and the temptation to scratch is very great. No digestive disturbances are seen, as a rule, unless there is the initial vomiting, which does not recur.

Desquamation slowly proceeds during the last two weeks of the disease, a few scales dropping off from day to day, usually leaving a dry base, lighter in color than the surrounding skin. Sometimes there is a decided ulceration, in case the vesicle has been infected.

Complications and Sequelæ.—The only complication of moment I have ever seen was an *crysipelas*, which was very severe and extensive, and which proved fatal.

Varicella gangrenosa has been reported as a complication. This is extremely severe and usually fatal. *Ulceration* at the site of one or more of the vesicles may take place, extending into the true skin, and these always leave a pitting scar. It is quite usual to find one or more of these pits somewhere upon the body.

Hemorrhage may rarely occur in the vesicles. Second attacks are practically never seen.

True *nephritis* may be a complication, albumen is frequently temporarily present.

Diagnosis.—The chief disease to be diagnosed from is small-pox of a mild type. Corlett gives the following diagnostic points: (a) *Varicella* has mild prodromal symptoms, and

they may be absent altogether. (b) The eruption appears on the trunk, where it is more abundant than on the face and hands. (c) The multiform character of the eruption, its superficial position, comparable to drops of water sprinkled over the skin, and its appearance on the same region in successive crops. (d) Its mild constitutional symptoms and short duration, the disease usually terminating in 5 to 14 days. (e) It is mildly infectious and always gives rise to the same disease.

Prognosis.—In uncomplicated cases is always good.

Treatment.—Isolation is the principal consideration. Attention to the bowels is very necessary with an initial dose of calomel. A simple diet should be given, preferably only liquid or soft food, according to the age of the child. Confinement to bed is necessary only during the febrile stage. If the child is old enough it should be warned against scratching, if too young its hands should be covered in order to prevent it. A 2 per cent carbolic acid vaseline ointment will prevent itching and make the patient more comfortable. The bowels and digestion must be watched and daily baths given.

VACCINATION.

Synonym.—*Cowpox*.

Definition.—This is an eruptive disease in the human race caused by the introduction into the system of the small-pox virus or lymph, obtained from one of the vesicles.

History.—Edw. Jenner, in May, 1796, after observation of cases of cowpox in milkers and the immunity it gave those contracting it, performed the first vaccination on the human subject. The first vaccination in America was performed in 1800 in Cambridge, Mass. Statistics prove what a boon to humanity has been the discovery of vaccination.

Technic.—A child should be vaccinated before the end of its first year, and revaccinated at the end of every seven years. Statistics have shown that in cases of small-pox occurring in persons giving a history of a successful vaccination, the vaccination was usually done more than seven years previously.

Vaccination should not be done in a child who is acutely ill or who has a skin lesion, or in a child suffering from any of the

diseases of malnutrition. The occurrence of an epidemic of small-pox is the only reason for not making these exceptions.

The site of the vaccination has been the subject of much comment, whether it should be done upon the leg or the arm. Owing to the possibility of an infection occurring after the operation and the greater number and size of the inguinal lymphatics, the choice of the arm should always be made. The point of selection is just above the insertion of the deltoid muscle upon the arm least used, the left arm in the right handed, and vice versa.

The *selection of the virus* should be made with care: The scab from a human vaccination scar should never be used because of the danger of infection. Only bovine lymph should be employed and the glycerinated lymph is best, as this form of lymph is sterile and there is no chance for it to become contaminated with bacteria. The glycerinated lymph is furnished by reliable firms in sealed capillary tubes and in hermetically-sealed tubes containing glass or ivory points, upon which is smeared the virus.

The operation should be considered strictly a surgical procedure and performed with great care and in a surgically, cleanly manner. The arm is bared, washed with soap and water, and dried, but no antiseptics should be used. The skin should be scarified over an area one-half inch square, and the lymph rubbed into this and allowed to dry. A sterile, medium-size, cambric needle can be used for the scarification, care being taken not to make the scratch deep enough to draw blood, or the end of the point can be used to rub off the upper skin. It usually takes 15 or 20 minutes for the lymph to dry. To facilitate the child's having its sleeve pulled down, cut a piece of light cardboard, round, $1\frac{1}{2}$ to 2 inches in diameter, and then cut it half through. The cut edges are slipped by each other and a cone formed. This is held in place by narrow strips of adhesive plaster. When the lymph is dry the improvised cone shield can be removed.

The after-care of the vaccination area should be mentioned. Bad results are due to infection transmitted to the wound after the vaccination has been performed, and not to contaminated

virus, provided the virus from a reliable maker has been selected. After the wound has dried it usually needs no attention or protective dressing, unless it be one or two layers of gauze bandage. A typical vaccination will run its course without breaking down or becoming moist. If it does become moist and the sleeve sticks to it a shield which is perforated, has a wide base to rest upon the arm, and large enough to make no pressure on the vesicle, should be applied as a protection. If the wound becomes infected with pus formation it should be treated surgically as other wounds.

Normal Course.—Upon the third or fourth day following a successful vaccination, the area scarified becomes red, and slightly indurated and raised. Upon this area, on the next or second day following, a vesicle forms, slightly smaller than the red area, which is decidedly umbilicated. The reddened area spreads to half an inch or more in width, with perhaps a congested area, much lighter in color, extending 2 or 3 inches or encircling the entire arm. The vesicle at first is pearly white, gradually changing in color to a yellow or brownish color, and then drying up, if normal, without rupture. A distinct scab forms which gradually loosens, leaving a dry scar, slightly depressed, and containing a number of smaller depressions or pits.

The time usually required for a "take" is as follows: Fourth day, indurated red area or papule; sixth day, vesicle; tenth day, pustule; twelfth day, scab; fifteenth to eighteenth day, scab separates, leaving the scar.

Symptoms.—Coincident with the formation of the vesicle there may be a rise of temperature from 3° to 5° , 101° to 103° F., and may last until the formation of the scab. The arm feels swollen and stiff, and there may be some glandular enlargement in the axilla, and pain. Around the vaccination area several small pustules may form which are superficial and leave no scars.

Complications.—The chief complications which occur are those referable to the skin, and the most striking is a *general vaccinia*.

This is an eruption which is like that seen in some cases (and referred to above) occurring around the site of the vaccination, pustular in character, appearing about the tenth day, and if

closely watched passing through the papular, vesicular and pustular stages.

A general *erythematous* eruption is more frequently seen, resembling a measles eruption. This may occur only on the trunk or around the waist, buttocks and thighs. It is hot, slightly raised and itches a good deal, and usually is of short duration, lasting from a few hours to two or three days.

An *urticaria*, similar to that complicating the injecting of any of the sera subcutaneously, may occur.

A *cellulitis* about the vaccination area is a common occurrence. The entire arm may be involved, it is greatly swollen, very tense and painful, the arm is very "sore." In these cases the vesicle is apt to rupture, and the whole area occupied by the vesicle may become gangrenous.

In the colored race, especially, and frequently in the white, a *keloid* forms in the scar tissues left after the separation of the scab, which may become raised above the surface of the skin, and is firm and glazed.

An *adenitis* sometimes develops, in the axilla or groin, the glands being enlarged and tender during the inflammatory stage of the "take."

The distinctness of the vaccination scar is not sufficient evidence of the persistence of immunity conferred by a single vaccination. It is frequently found that a typical "take" is recorded in a person with an excellent and typical mark if more than seven years have elapsed since the first vaccination.

A natural immunity does not exist. If a primary "take" has not been obtained there has been some fault in the technic, and the operation should be repeated until successful. I have revaccinated myself until on the fifth attempt a successful "take" was obtained.

VARIOLA.

Synonym.—*Small-pox.*

Definition.—The most contagious of the exanthemata characterized by a sudden onset, high fever, a rash, going through regular stages of development, viz., papule, vesicle, pustule, scab, desquamation and cicatrices. If one unprotected by vaccination is exposed to the contagion he is practically always attacked.

Etiology.—It is believed by Councilman and others that the organism, the cause of small-pox, has been isolated, though it has not been cultivated on artificial media. These bodies are described as occurring “in epithelial cells, in the nuclei and free.”

The disease is contracted by direct contact and the contagion can be carried upon the clothing, etc. The most virulent carrying medium is the pus from the pustules, and the scabs which later form, and the excreta. The organism gains entrance to the body through the mucous membrane. The contagion can be carried through the medium of the air. It is contagious from the first symptom until desquamation is complete.

Segregation in cold weather increases the frequency of small-pox.

Symptoms.—Several types are recognized, *variola vera*, which may be confluent or discrete; *hemorrhagic*; *varioid* or modified form.

The *ordinary form* has the following periods, *invasion*, *incubation*, *eruption* and *desquamation*.

Invasion.—According to different observers the stage of *invasion* lasts from 8 to 20 days, the average being probably 15 days. There are no symptoms to this stage.

Incubation.—The symptoms of this stage vary according to the age of the patient. In the young it is frequently ushered in by a convulsion, nausea and vomiting. In the adult, there may be a chill, instead of the convulsion. There is regularly a rapid rise in temperature, usually reaching 104° F., without much variation, severe headache and pain in the back in the region of the loins. This pain is perhaps the most prominent symptom. The bowels may be disturbed, but not regularly so. The pulse is consistently rapid.

Eruption.—On the third day, sometimes on the second, a macular eruption appears on the forehead, at the margin of the hair particularly, face, wrists and forearms, and neck, which by the fourth day is decidedly papular. The papules soon appear on the extremities, palms and soles, and in less numbers on the body. These have a distinct shotty feel. The first day they may be difficult to diagnose. It quickly spreads to the rest of the

body. On the summit of the papules vesicles form about the fifth day, which gradually change to pustules by the tenth day, and by the fourteenth day these have become encrusted, with a shedding of some of the crusts. The desquamation proceeds in the order of the appearance of the rash.

An enanthem forms coincidently with the exanthem.

The vesicles have a decided umbilication or depression, which remain until the pustules form. If pricked these vesicles do not collapse because of the reticular division inside them. After the scabs fall off the skin is left slightly discolored, and according to the depth of the ulceration a pit or depressed scar remains. There may be a coalescence of the pustules on the face, or they may rupture, the pus drying upon the skin forming a crust over the entire face.

The fever runs a fairly typical course, sudden of onset, reaching 104° or even 106° F. the first day, and remaining up until the eruption appears, when it gradually recedes to normal or very slightly above, about the fifth day. It remains down then until the pustules are formed, about the tenth day, when it reaches usually the height it was at first, or even higher. This is the secondary fever. Fever persists during the pustular stage, gradually falling; symptoms abate, the restlessness, back-ache, headache, etc., improve.

During the septic temperature there is a return of these symptoms to a certain extent, and they may be very severe. Absorption may be enough to cause septic symptoms of gravity, the patient being drowsy or even delirious.

In the *confluent* variety, in which there is a coalescence of the vesicles and pustules, all of the symptoms are more severe.

Hemorrhagic Variola. This form is the most severe. There is an extravasation of blood in the vesicles, either as a primary lesion or the blood appearing during the pustular stage.

Varioloid. This is a modified form of small-pox occurring in individuals in whom the immunity from a previous vaccination has about disappeared, and is as contagious as variola, a severe true small-pox may be caused by it. In varioloid there is very little eruption and no secondary fever, all of the symptoms being very much less severe, and of shorter duration.

Complications.—These are few, as a rule. The pustules may cause deep ulceration and consequent *pitting* and permanent scarring of the *skin*.

There may be a catarrhal or purulent inflammation of the *middle ear*. The *eyes* may be involved, an ulceration of the cornea being sometimes found. A *laryngitis* is not infrequent, and an extension downward causing a bronchopneumonia or edema of the pharynx and larynx may occur. *Furunculosis* and *adenitis* occasionally occur during the convalescence. *Arthritis* may complicate the disease.

Diagnosis.—Until the appearance of the rash the diagnosis cannot be positively made, but when a sudden high temperature is seen with severe headache and backache, in the absence of an epidemic of grippe, small-pox should be suspected. The most frequent disease with which it is confused is chicken-pox. The great infrequency of chicken-pox occurring in adults should cause variola to be suspected in every vesicular eruption. The discrete eruption in varioloid and the mildness of the general symptoms are deceptive.

Prognosis.—Vaccination and age influence the prognosis greatly. The mortality in late epidemics has been very light. In the unvaccinated young the prognosis is always grave. The extent of the rash upon the face is a good guide as to the severity of the attack. The hemorrhagic form is very fatal. The occurrence of any of the complications makes the prognosis less favorable.

Treatment.—*Prophylaxis.*—Vaccination, isolation and disinfection are the best methods of prevention. It is absolute by vaccination, the immunity thus conveyed lasting in its fullest from five to seven years. Revaccination should be practiced.

No city is safe from epidemics without the erection of an isolation hospital, removed beyond the city limits. The care of these cases should be left to the city authorities, and prompt report of cases in the city made to the Health Board should be required.

Disinfection should be most thorough, the formaldehyde, permanganate of potash method being very efficient. Bedding should be destroyed and the room thoroughly overhauled and

cleaned. Vaccination of every person known to have been exposed to a case of small-pox should be insisted upon, and its spread thus limited or stopped entirely.

Local.—The confinement of the patient in a room in which only red rays of light are admitted has been shown to be efficient in limiting the inflammatory reaction in the pustules, and consequent limiting of the amount of pitting or scarring.

The pain and burning in the skin from the eruption is best relieved by the local application of soothing, antiseptic lotions upon a mask cut from gauze. The following is of benefit:

℞ Acidi carbolicī puri liquefacti ℥ss
Zinci oxidi pulv. ℥i
Aquæ destillatæ q. s. ℥iv
M. ft. sol.

Sig. Saturate cloths and apply to face or other parts, at frequent intervals.

or

℞ Ichthyol ammon. sulph. ℥vi
Aquæ destillat. ℥iv
M. ft. sol.
Sig: Locally.

In the pustular stage the following is recommended:

℞ Acidi carbolicī ℥xv
Aq. calcis
Ol. Olivæ āā ℥ss
M. Sig. Locally.

In the event of eye involvement, pus exuding from the conjunctival sac, and danger to the cornea from ulceration being present, they should be frequently irrigated with a 5 per cent boracic acid solution, and an occasional drop of atropia solution introduced. Five per cent argyrol solution will be of benefit in the purulent condition sometimes seen.

Fever is best combated, both primary and secondary, by hydrotherapy, sponge bath, wet pack or tub bath. The use of baths during desquamation, followed by oil rubs, hastens this stage. The patient should be kept strictly in bed during the entire eruptive stage.

For the great pain in the back and head during the stage of

incubation, an opiate may be necessary. The coal-tar derivatives should be used with great caution.

Stimulation may be needed at certain stages, whisky, digitalis or strychnia.

The diet should be fluid, preferably milk, and broths with plenty of water.

Bromide and chloral can be used for the great restlessness.

PERTUSSIS.

Synonym.—*Whooping-cough.*

Etiology.—The organism which is now believed to be the specific cause of pertussis, was discovered by Bordet, working in collaboration with Gengou, in 1905, and is a small coccibacillus resembling the bacillus of influenza in size and shape. It is usually found in the viscid exudate expectorated from depth of bronchi during paroxysms of coughing. The organism may be stained with weak solutions of fuchsin and does not take the Gram stain. It grows best in a media made of equal parts of defibrinated blood (human or rabbit) and 3 per cent agar containing small quantity of potato extract and glycerine. It also grows fairly well on serum bouillon or blood bouillon, but on ordinary culture media only after it has been cultivated in the laboratory for some time.

While not universally recognized, the identity of Bordet's bacillus as a causative factor of whooping cough is fairly well established. The strongest evidence which we have is perhaps the agglutination and complement fixation reactions first observed by Bordet and afterwards confirmed by numerous investigators. Further evidence is afforded by an experiment of Bordet with vaccines prepared from this organism. Twenty children who had been exposed to whooping-cough were given prophylactic injections and in every case developed unusually violent cases, clearly indicating that a profound negative phase had been produced. Experiments on lower animals to determine the pathogenesis of this organism have been unsatisfactory. Ordinary laboratory animals are not infected by inoculations, but Klimenco and Fraenkel claim to have produced typical whooping-cough in monkeys by injections of this organism

Klimenco also believes that similar results were produced in puppies, but this latter work has been greatly questioned.

Although inoculations with small quantities of this organism into animals are not followed by the development of an infective process, larger doses kill animals with symptoms of profound toxemia, evidently due to toxins generated during growth on media. Toxins extracted from cultures of this organism injected into peritoneum of guinea-pig produce hemorrhagic and exudative lesions. Injected subcutaneously they result in edema and necrosis. Inoculated into the eye of a rabbit they produce necrosis of the cornea. Bordet calls attention to the fact that an analogous necrosing influence may be observed on the surface of bronchi of affected children and believes that the manifestations of this disease are due to lesions of the cellular lining of the bronchi, resulting from the action of this irritant poison. This coincides with the clinical fact "that whooping-cough ceases to be a part of the clinical picture immediately previous to convalescence at which time germs become rare in the exudate."

Its habitat is the nose and throat, and is directly transmitted from one child to another. It is not necessary for the infecting child to cough to transmit the infection, as it can be carried through the air from ordinary breathing, but the children must be fairly close together, and also by toys, clothing, etc. It is both endemic and epidemic. It is contagious at any time in its course. No age is exempt, though it is much more common between the ages of one and ten years, the majority of cases occur under three years old. The youngest child I have seen with it was six weeks old, the attack proving fatal. Cases much younger have been reported. One attack does not confer immunity in every case. My oldest child had two distinct attacks. I have seen one grandfather over 60 years of age with a severe attack.

Pathology.—There is a catarrhal condition of the mucous membrane of the nose, pharynx and larynx, and especially the trachea, with very frequent involvement of the bronchi as a complication. In severe cases there may be a true or a compensatory emphysema.

Symptoms.—The *incubation* is generally about two weeks.

There is a cough which shows no tendency to improve, and in spite of ordinary remedies grows more persistent, and without signs in the chest to account for it. This is usually described as the *catarrhal* stage, and lasts from one to two weeks, followed by the *spasmodic* and *whooping* stage and the stage of recession. In the catarrhal stage there may be a slight puffing of the lower eyelids, some loss of appetite and disinclination to play, as exertion tends to increase the cough. During the last of this stage the cough becomes more paroxysmal in character, the child going some time between the paroxysms without coughing. The paroxysms become spasmodic, they begin with a slight, hacking cough, which gradually becomes more severe, and ends in a long-drawn, deep inspiration accompanied by a crowing sound, which is the characteristic "whoop" from which the disease took its name. Once heard, there is no mistaking the sound. The child loses its breath for a moment and gets very red or dark red in the face, the eyes and nose run; the child runs to some one or grasps a fixed object for support, and with the last deep inspiration and whoop, may vomit the contents of the stomach, and mucus from the trachea. After the paroxysm is over the child falls back exhausted, its color gradually returns, and it may shortly resume its play. If the paroxysms are repeated very frequently there may be a deep injection of the superficial vessels in the conjunctiva or a subconjunctival hemorrhage. Between the paroxysms the child's face is puffy and bloated under the eyes, due to lymphatic stasis. There may be an ulcer under the tongue in children with lower teeth.

Paroxysms are brought on by severe exercise, eating, often a drink of water, excitement, and usually recur every half hour to an hour in the 24, but there are often many more than this. If a count can be kept of the number of the paroxysms, day and night, the effect of medicinal treatment can best be noted, as a lessened number of paroxysms would be the first improvement.

After about two weeks, or more, of the severe paroxysms their frequency and severity both become less, and in this period of decline, the child shows a general improvement. It does not vomit now with each paroxysm and sleeps longer at night.

During this stage, if the child acquires a fresh "cold," its cough partakes of the same paroxysmal nature, and, in fact, for some weeks afterward.

Complications.—The most frequent is a *bronchitis*, though a *bronchopneumonia* is often seen. An *emphysema* may occur in very severe cases, which is more or less permanent. From the passive congestion, due to bronchial involvement, there are apt to be *hemorrhages* from the nose and into the conjunctiva and brain. *Hernia* may result from the straining at coughing, and the *rectum* may also be forced out in young children. *Incontinence* of *urine* during coughing is not infrequent. Albumen and casts may be found in the urine during the height of the attack. The simultaneous occurrence of measles and pertussis has been often reported. *Tuberculosis* may have its starting point in an attack of pertussis. *Convulsions* may occur in the young.

Diagnosis is not at all certain, and is most often made by the mother and nurse before seen by the physician. A history of exposure, and paroxysmal coughing, even without the whoop, is sufficient for a diagnosis. In an epidemic one may see severe paroxysmal coughs and absolutely no tendency to whoop. The diagnosis must be made from tubercular bronchial glands, hypertrophied tonsils and chronic bronchitis.

Churchill¹ and others have made investigations as to the differential blood count during whooping-cough. Comparing the lymphocyte count in whooping-cough with a normal count of a child at 10 years, which will average 32 per cent, in whooping-cough it will run from 34 per cent to 93 per cent.

Mosenthal² found in "institutional" children the average leucocyte count to be 13,850 to 16,391. The percentage of polymorphonuclear cells is slightly diminished with a corresponding increase in the mononuclears.

During the catarrhal stage of pertussis, an increase in leucocytes is found, approximating double the normal, and the mononuclear cells increased about 5.5 per cent.

A hyperleucocytosis, with an increase in the percentage of

¹ Journal American Medical Association, 1906, volume xlv, 1506-9.

² Archives Pediatrics, November, 1908.

mononuclear cells at the expense of the polymorphonuclear, is an aid to the diagnosis of pertussis in the catarrhal stage.

Prognosis.—In very young children the prognosis is always grave because of the lack of nourishment, the physical exhaustion due to the coughing, the tendency to the occurrence of complications. Too little attention is paid to whooping-cough, as a rule, and there are too many wanton and willful exposures to it, “that the child may have it while it is young,” for many a child dying of pneumonia had whooping-cough as the chief factor in the fatality. The more frequent the paroxysms and the vomiting, the graver the prognosis. The beginning of an epidemic in institutions is greatly to be feared. In the 1902 census whooping-cough ranked fourth as a cause of death. In 1906 it caused more deaths than measles or scarlet fever.

Treatment.—*Quarantine* of the affected child should always be insisted upon, and municipal control of the quarantine should be possible. The *diet* should be in small amounts, and principally of *milk*, especially if vomiting is a prominent symptom. It may be necessary to peptonize the milk, or to give one of the predigested foods.

Fresh *air* is most essential and the more these children are out of doors the better. The room temperature should range between 55° F. and 60° F. The tendency to bronchitis must be remembered and the child perfectly protected from draughts.

Local and Medicinal.—A great number of drugs have been recommended for pertussis, but no one can be relied upon in every case. A much-vaunted remedy is the vaporizing with a lamp of one of the phenol preparations. This has been reported of service by some, but is a dangerous remedy as carbolic acid poisoning is a possibility. The room full of fresh air is decidedly more beneficial.

Internally several remedies are used more generally than others, viz., antipyrine, bromide, quinin, codeine, belladonna and bromoform.

Antipyrine can be used in doses of 1 grain to each year of the age, up to 3 grains every two hours, with syrup of tolu as a vehicle. Quinin can be added to this prescription or given alone, up to 3 grains at a dose, or with glycyrrhiza or yerba

santa. Bromide can always be given with either of these mentioned.



Fig. 73.—The whooping-cough belt. (Kilmer.)



Fig. 74.—Rear view of the whooping-cough belt applied. (Kilmer.)

Codeine is a valuable assistant to any of the above, and can be given for its effect.

Belladonna is probably best given in the form of the fluid

extract ($\frac{1}{2}$ min.) or tincture (2 min.) doses, and it must be given for its physiological effect.

Bromoform is a dangerous drug, because of the difficulty of forming a perfect mixture, and the invariable settling of portions of it to the bottom, and the last two or three doses containing perhaps a lethal dose of the drug. I have seen three children put to sleep for many hours by being given the last three doses in the bottle.

Sior¹ recommends the use of euchinin as a substitute for quinin in the treatment of whooping-cough. It is recommended in doses of a centigram for each month, and a decigram for each year, twice a day, morning and night, given in sugar, milk or cold chocolate. It can also be given in suppositories. The report of the cases in which it was used showed a cessation of vomiting, disappearance of cyanosis and a shortening of the duration.

Dr. T. W. Kilmer has reported a number of cases materially benefited and the attack shortened by the wearing of an abdominal binder, made of linen with a strip of elastic webbing under each arm and lacing up the back. He claims for it that the paroxysms are reduced in severity and number, vomiting relieved and complications less frequent.

One of the several preparations of chestnut leaves may be used with good effect in some cases.

After the child has ceased coughing it should be given a tonic, which will make up the leucocytosis and low hemoglobin which is nearly always present.

The employment of pertussis vaccine as a prophylactic and curative agent has been successfully used.

As a prophylactic agent two injections are given, 25 million the first dose, and in four days fifty million. As a curative agent four injections are given at intervals of four days, the initial dose being but 25 million.

PAROTITIS.

Synonyms.—*Mumps, epidemic parotiditis.*

Etiology.—The infecting organism is not known. It is very contagious, occurs epidemically as well as in endemics; affects

¹ Jahrb. fur Kinderhk., 1908, p. 452.

children more often than adults, and chiefly between one and five years of age. The contagion is taken into the system through the nose or mouth and from close contact. Immunity is conferred by one attack.

Symptoms.—The incubation period may be as long as three weeks, though it is usually much shorter. There are, as a rule, one or two days of lassitude, headache, anorexia, perhaps nausea and vomiting. The temperature usually reaches 101° to 103° F., and is at its height with the enlargement of the parotid gland. The parotids usually enlarge by the fourth day, assuming large proportions. The child complains of pain or soreness on swallowing, stiffness at the angle of the jaw, during and after eating the glands usually feel very tense. Acids usually cause great pain on swallowing.

The swelling primarily may not be very great, it is located directly under the lobe of the ear and is soft and elastic on palpation. It gradually increases in size. After about ten days the swelling subsides, the stiffness in the jaws and the pain on swallowing disappear.

Complications.—A coincident involvement of the submaxillary glands may occur, and there may be a metastasis in the testicles or ovaries. In males there is pain in the scrotum, with rise in temperature, probably preceded by a chill. The epididymis becomes enlarged and tender, and there may be an involvement of the testicle also. With an ovaritis in the female there may be pain and enlargement of the breasts. Earache with or without deafness is often seen.

Prognosis.—Barring complications the prognosis is uniformly good.

Treatment.—Isolation and protection from exposure are the chief indications. The application of heat to the enlarged gland is of service in relieving pain. The glands should be covered by a piece of dry flannel by carrying the bandage under the chin and over the ears, and pinning on the top of the head.

A laxative should always be given early in the attack, preferably calomel followed by a mild saline.

The diet should be liquid as chewing is usually painful. The mouth should be cleansed, and if an orchitis develops the testicle

should be supported by hammock-like arrangement made by folded towel or a suspensory. Guaiacol in 25 per cent ointment has been found serviceable in many cases of epididymitis, giving great relief from swelling and pain.

LA GRIPPE.

Synonyms.—*Influenza, grip.*

Etiology.—This is due to the invasion of the bacillus known as Pfeiffer's bacillus, described first in 1892. It is short and small, and is found in the secretions from the nose and respiratory tract. It grows on various media to which blood has been added. It stains with a carbolfuchsin, 10 per cent solution. They appear either in masses or threads of short, thick rods and resembles a diplococcus with rounded ends. They are found in the pus cells which are present in the nasal secretions later in the disease, and at this time the streptococci and staphylococci are associated with the Pfeiffer bacillus. It gains entrance through the respiratory mucous membrane.

Epidemics of grip have been described for years and they sweep over the whole country at intervals. It attacks both adults and children, but without regularity. More children seem affected in some epidemics than adults. It may occur at any age, and is readily communicable from one person to another. Some persons are specially susceptible, having recurrences both during the same and different epidemics.

Pathology.—There is no distinct pathology due to the bacillus itself, the pathological changes being chiefly due to the bacteria usually found with it. These changes are chiefly a catarrhal condition of the respiratory mucous membrane. There may be a general enlargement of the lymph nodes and of the spleen. Involvement of any organ or membrane may be present, and tuberculosis may easily be engrafted.

Symptoms.—Several types are encountered in an epidemic, the chief symptoms being referred to the *respiratory* organs, the *muscular* system, the *nervous* system or the *gastroenteric* tract. The symptoms of each type may be present with those of one being most prominent.

In all forms there is apt to be the initial chill, followed by fever up to 103° or 104° F. The period of invasion is short and generally without special symptoms, not more than a week and the *incubation* a day or so, during which time there is usually a dull headache, loss of appetite and irritability. Usually the prostration is out of all proportion to the symptoms.

In the *respiratory* form there are signs of a cold in the head, sneezing, suffusion of the eyes and swelling of the nasal mucous membrane. This is followed by a cough and expectoration, with probably pain in the chest. The physical signs are those either of a bronchitis or a bronchopneumonia, according to the involvement. The occurrence of pain on inspiration, hurried respiration and pulse, in the pneumonic ratio, and a rise in temperature is usually enough to complete the diagnosis. Usually there is more or less muscular aching in this variety also. The bacilli can be found in the nasal secretions.

In the *muscular* form, following the chill and initial vomiting, there is headache and pain in the back, joints and muscles of the arms and legs. The child cries when handled and prefers to lie in its bed. The fever is quite high, and the pulse accelerated.

In the *nervous* form there may be convulsions in the very young, with severe headache when the child is able and old enough to complain; there is photophobia, great restlessness, irritability and nervousness. The prostration is severe and convalescence more prolonged in this type. Where convulsions are present meningitis may be suspected, and a lumbar puncture needed to clear up the diagnosis.

The *gastroenteric* form is seen oftenest in the younger patients. Vomiting is always present, the bowels being also upset with thin, green and mucous stools at frequent intervals. There is anorexia and coated tongue, with tympany, restlessness and fever.

Complications.—The chief complications are the inflammations of the respiratory tract found in all of the varieties. These may be caused by the influenza bacillus alone, but usually there are associated the pyogenic cocci as well.

Transient albumen may be found in the urine or a true nephritis may follow an attack.

One of the most frequent complications is an involvement of the sinuses contiguous to the nares and the ear. Frontal sinus inflammation, middle-ear inflammations and mastoiditis are very frequent. During the last epidemic in this section of the country these complications were of very frequent occurrence.

Malnutrition and athrepsia may follow acute grip in younger children. Synovitis may occasionally be seen as a complication.

Diagnosis.—In the presence of any epidemic the diagnosis is usually easy, but in most cases it must be made by exclusion. Bacteriological diagnosis is difficult as Pfeiffer's bacillus is not easy to find or to grow.

A complicating tonsillitis or bronchitis makes the diagnosis more difficult. The following diseases must often be excluded, bronchopneumonia, especially the central type, pyelitis, and tonsillitis. The fact that the prostration in influenza is apt to be more profound than in any of the diseases mentioned is an aid in differentiation.

Prognosis.—Uncomplicated, the prognosis is good; with a pneumonia it is more or less grave. Severe gastrointestinal complications are difficult to recuperate from. Convulsions make the progress less favorable.

Treatment.—Isolation of cases of grippe is most important. Children should be carefully isolated from other members of the family, ill with influenza. Keep the patient strictly in bed, in a well ventilated room, giving easily digested and nutritious food. Milk, diluted, is the best all-round food, except in the gastrointestinal type, in which the cereal gruels and broths are best.

An initial dose of calomel, followed by oil, is of great benefit.

The coal-tar products should be given with the greatest caution, and never without one of the diffusible heart tonics is given with it, as caffeine alkaloid, 1/10 grain, camphor, 10 minims of a 10 per cent oil solution, hypodermatically, or strychnia, 1/200 grain, to a child of two years.

The salicylates have the best reputation as affording relief from the pain and can be given in any form, perhaps best in the form of aspirin, in 1 to 3 grain doses to a child of two years. Codeine can be used to advantage.

Quinin to older children can be combined with the aspirin in

capsule or yerba santa as a vehicle. Vigorous stimulation may be needed and, of course, when needed it is urgent.

In no other condition, perhaps, is a tonic treatment so indicated as in the convalescence from la grippe, and especially in the respiratory and gastrointestinal forms, some preparation of cod liver oil is of the greatest benefit.

Hydrotherapy for the fever in the form of sponge or full baths.

DIPHTHERIA.

Definition.—This is an acute infectious and transmissible disease, characterized by the deposit of a false membrane, caused by the action of a specific organism, the Klebs-Loeffler bacillus. The pseudomembrane may develop on any mucous surface or on a denuded area on the skin. It is primarily a local disease, and the severe general symptoms and the complications are due to the toxins formed by the bacilli.

Etiology.—Diphtheria is caused by the Klebs-Loeffler bacillus. In the majority of cases the source of the infection cannot be traced. It may be endemic or epidemic. Milk, contaminated food, toys, cats, feeding utensils, books, clothing, linen, etc., may carry the bacillus. No race or people is more prone to develop diphtheria than another. Infants under six months are rarely affected and adults are much less susceptible. It is most frequent between one and ten years of age, perhaps the most cases during this period occurring between three and five years.

The most potent predisposing cause is the condition of the nose and throat, accompanying adenoids, chronically enlarged tonsils and chronic nasal catarrh. Any condition of the general system which lowers the resistance will act as a predisposing cause, as la grippe, bronchitis or other pulmonary diseases.

Bacteriology.—No attempt will be made to give an exhaustive description of the Klebs-Loeffler bacillus, the reader being referred to special works on bacteriology for that. It is of interest to note that it was not until 1883 that Klebs first described a bacillus constantly found in throats of patients dying of diphtheria, and a year later when Loeffler obtained the bacillus in pure culture and gave his knowledge to the world.

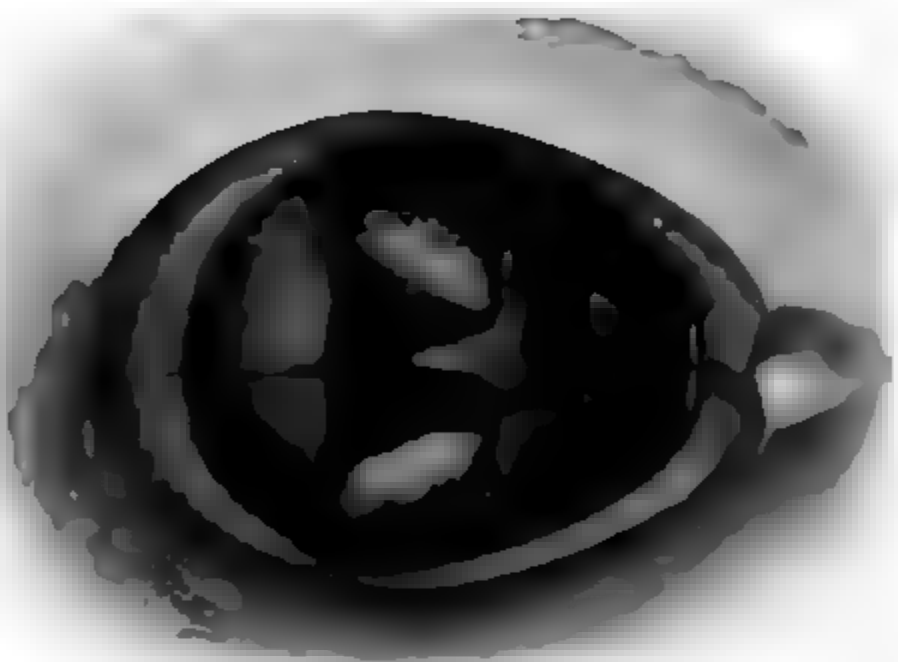


PLATE III.

TONSILLAR DIPHTHERIA.

(Courtesy Dr. John Zahorsky)

FOLLICULAR TONSILLITIS.

The bacillus is aerobic, but grown also without oxygen, and grows best on serum media. It is rod shaped, straight or slightly curved. Usually with clubbed ends, varying greatly in its measurements. It stains with ordinary aniline dyes, the most satisfactory perhaps being Loeffler's methylene-blue stain.

In bright sunlight the bacillus will not long survive, but it does live for a long time in the dark, in the mouth, and on toys, etc. Disinfectants have a very speedy effect. It is killed at (70° C., 136° F.) with five minutes' exposure.

When other bacilli are present in diphtheria it is called a *mixed infection*. The most frequently associated forms of bacteria found are the streptococcus, staphylococcus and pneumococcus. It has been shown that the primary invasion is not infrequently with the streptococcus, the diphtheria bacillus being engrafted upon the soil prepared for it.

The streptococcus is most frequently the cause of some of the complications met with in diphtheria, chief of which is bronchopneumonia.

The Membrane.—Membrane may appear upon the mucous membranes of the nose and throat due to other organisms than the Klebs-Loeffler bacillus. The characteristic diphtheria exudate is of a grayish-white color, and is firmly attached to the underlying mucous membrane. When it is removed it leaves a bleeding area beneath. There is a swelling of the membrane surrounding due to an edema.

The development of an exudate on the tonsil alone may be a simple follicular tonsillitis, and when no history of exposure is given it may be difficult to make a positive diagnosis, but the appearance of a membrane upon the mucous membrane of the nose, nasopharynx or uvula, is very suspicious of a true diphtheria.

Cultures from this membrane will clear up a diagnosis, and this may often be necessary.

Bacteriological Diagnosis.—Sterile blood serum is best used for the first growth. A culture is obtained from the throat by a probe, the end of which is wound with sterile absorbent cotton. This is rubbed over the membrane, being careful not to touch any other part of the throat or tongue. The child is held with

face in good light, and tongue held down with depressor. The inoculated swab is then rubbed over the surface of the blood serum of the culture tube, without breaking the surface.

The tube is incubated at a temperature of 37° C. for 12 hours; experts can differentiate at the end of five hours. With a platinum needle a number of the colonies are scraped off the culture medium, some of this is washed off on to a cover glass with a drop of water. The cover glass is air-dried, passed three times through a flame, stained with an alkaline methylene-blue solution (Loeffler's) for 10 minutes, cold. It is then rinsed, dried and mounted in balsam. It is examined with a 1/12 oil-immersion lens. The diphtheria bacilli may be found in great numbers, or a few with a preponderance of streptococci in chains.

Direct examination of the exudate is uncertain and unsatisfactory.

Virulent bacilli have been found in healthy throats, and numerous observations have been made which show they persist in throats for a long period of time after the disappearance of the exudate. Park¹ reports one case in which they were found, eight months after the disappearance of the membrane. A pseudobacillus less virulent is sometimes found in the throat, but it is believed these have been derived from the virulent form.

The bacilli generate a poison or toxin, and this can be obtained from cultures of living bacilli, by filtration through porcelain.

An artificial immunity can be produced in the economy by the introduction of an antitoxin, a substance which will act as an antidote to the toxin. Natural immunity more or less active may exist in the human being. The blood serum of a person convalescent from diphtheria contains this antitoxin, but it disappears after a few weeks.

Diphtheria antitoxin² is obtained by first growing a virulent culture of bacilli, sterilizing them by adding carbolic acid solution. The solution is siphoned off, leaving the bacilli at the bottom. If 0.005 cc., when injected into a guinea-pig, will kill it promptly it is of the correct strength; 250 grains weight of this solution, or enough to kill 5000 guinea-pigs, is injected into a horse, and this is repeated every three to five days, or until

¹ Park: Pathogenic Bacteria and Protozoa.

² Park: loc. cit.

the fever reaction has subsided. This is kept up until at the end of 20 months 10 to 20 times the amount originally given is used. At the end of six months the horse is bled from the jugular vein, and from the serum of this blood the antitoxin is obtained.

The antitoxin is standardized by inoculating a guinea-pig weighing 250 grams with 100 or with 10 fatal doses of standardized toxin, with which has been incorporated an amount of antitoxin believed to be sufficient to protect from the toxin. If the guinea-pig lives for four days, but dies soon after, the amount of antitoxin added to the toxin was just one unit.

Pathology.—A study of the exudate or pseudomembrane is the chief consideration in this section, though the pathological changes occurring as complications must be considered.

The pseudomembrane may be situated on any mucous membrane of the body or upon the skin upon which there is an abrasion. In the order of frequency of involvement might be mentioned the tonsils, uvula, nasopharynx, nose, conjunctiva, larynx, trachea, and vagina.

The exudate is grayish-white in color, and dips down into the mucous membrane beneath, being intimately attached, and leaves a bleeding surface when pulled off. It is composed mostly of fibrin, leucocytes and diphtheria bacilli in pure culture or mixed with the other organisms previously mentioned.

The nerves are specially acted upon by the toxins, the peripheral nerves being the ones chiefly affected. This degeneration may be parenchymatous, interstitial or fatty. The cord and brain may undergo degeneration also. The muscles may show a degenerative change without nerve involvement. One of the principal muscles involved is that of the heart, fatty infiltration and degeneration being the chief change.

Bronchopneumonia is frequent, but chiefly due to the associated bacilli, streptococcus, staphylococcus and pneumococcus.

The lymphatic glands, especially about the neck, are enlarged due to cell infiltration with occasional hemorrhages.

The kidneys may show involvement also from the toxins, similar to the degeneration accompanying the other acute infectious diseases. The parenchyma and glomeruli are principally involved.

Symptoms.—The clinical classification, according to the location of the membrane, we consider the best. If a bacteriologic examination is made it may be further classified according to these findings, a pure culture of the diphtheria bacillus or a mixed infection, in which other bacteria are found in addition

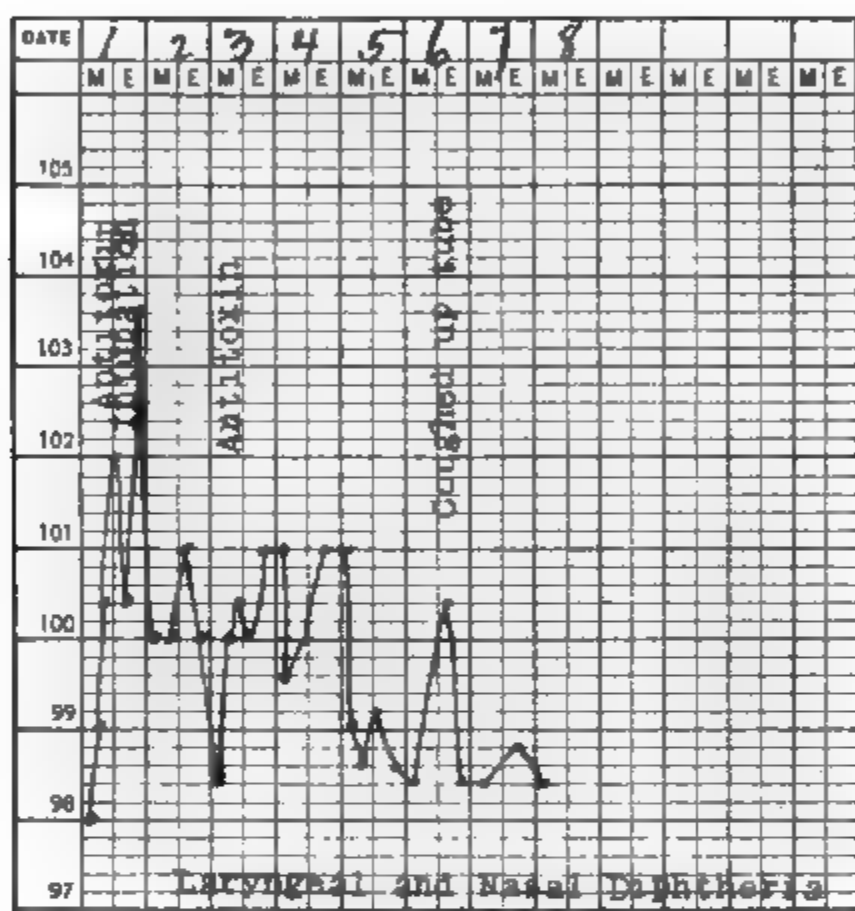


Fig. 75.—Laryngeal and nasal diphtheria, intubation.

to the Klebs-Loeffler bacillus. These are chiefly the streptococcus, staphylococcus and pneumococcus.

The onset is usually gradual; the child may complain of general malaise, beginning frequently with vomiting. The fever does not run a characteristic curve, its height and course depending upon the amount of toxemia, the amount of the individual resistance or immunity, and the amount of mixed infection. In mixed infection it is apt to run much higher than in pure culture form. It is present to some extent in all cases averaging from 101° F. to 102° F.

The pulse rate is always increased, depending upon the amount of toxemia, and not in proportion to the height of the tempera-

ture. A very rapid pulse is not a good sign. The younger the patient the more rapid the pulse.

The child may or may not complain of its throat, may only have pain on swallowing, or severe dysphagia may be present. The degrees of this symptom depends entirely upon the amount of infiltration in the tissues of the throat.

The tonsils and uvula may be covered with a thick exudate and the child not complain of its throat, especially if it has been hurt previously in an examination of the throat, and if but a little sore, fears another examination. Hence, the importance and the absolute necessity of examining the throat in every sick child as a matter of routine.

The membrane described above is found on one or both tonsils or the uvula in addition. The glands are enlarged about the angle of the jaw and at the back of the neck.

The child refuses nourishment or takes very little at a time. The urine is high colored and much more scanty than normal. According to the amount of toxemia will albumin and casts be found. The urine should be regularly examined for albumin, and when present a microscopic examination made also, though a microscopic examination should be made as a routine measure.

Generally a leucocytosis is present, its amount depending upon the membranous involvement. The hemoglobin and red blood cells are relatively decreased.

If there is nasal involvement there will be a discharge from the nostrils, which is apt to be blood tinged, and an excoriation of the skin of the upper lip occurs. There is obstruction to the breathing through the nose and in the breast or bottle fed, nursing is interfered with. The nasal variety occurs infrequently in the very young, and it may be seen as a primary lesion, though it usually occurs as a complication of the faucial form.

My experience has been that in primary nasal diphtheria the symptoms are as a rule more severe than in the uncomplicated faucial variety, though there are cases in which the diagnosis may not be made. Where the diagnosis is not made, and the case looked upon as one of a severe "cold," it is a great menace as a distributor of the infecting organism. If both fauces and

nares are covered with membrane the toxemia is apt to be very severe.

If the membrane occurs in the *larynx*, as a primary condition, there are apt to be three stages, the stage of invasion, in which the child is listless, has some fever, perhaps a slightly croupy cough, and lasts from a few hours to 24, the spasmodic stage, in



Fig 76 A Diphtheritic casts of trachea and B Diphtheritic cast of nose (Case of Dr Lee Kahn)

which the membrane has formed. In this the croupy symptoms are exaggerated, the cough more spasmodic, there is very decided stridor, with recession of the suprasternal and supraclavicular spaces. As a late phenomenon, before the third stage or stage of asphyxia occurs, the intercostal spaces and epigastric region recede with each inspiration. In the stage of asphyxia all the extraordinary muscles of respiration are brought into play.

From the beginning of the second stage, when obstruction has begun from the membrane forming, the child is restless, sleeps fitfully, and the depression is very profound. The pulse is accelerated out of ratio to the respiration.

As obstruction advances there is cyanosis, blueness of the lips and about the nose, finger and toe nails, clammy skin, cold extremities, and unless relieved death quickly ensues.

The enlargement of the lymph nodes of the neck, and at the angle of the jaw is quite marked in all of these forms.

Complications and Sequelæ.—*The Kidneys.*—Albuminuria occurs in about 60 per cent of cases, and in a smaller percentage there are evidences of a parenchymatous degeneration, hyaline and granular casts, with occasionally blood casts.

Lungs.—In the mixed-infection cases bronchopneumonia is a frequent complication. The consolidation is usually along the posterior borders of the lungs, patchy in its extent. This complication is less often seen in pure-culture forms of diphtheria.

The first evidence of a complicating pneumonia is a sudden increase in the number of respirations with dilatation of the *alæ nasi* and a rise in the temperature.

Bronchitis is frequently seen evidenced by an increase in the cough, respirations more rapid and slight rise in temperature.

Nervous System.—Perhaps the most important changes occur in the nervous system as a result of the toxemia. These complications were more often encountered before the antitoxin was discovered.

The changes are those of a fatty degeneration, usually, and it evidences itself by paralyses of various muscles. It most often begins during the stage of convalescence, perhaps several days after the case has been dismissed, though it may occur early. The group of muscles most frequently involved is of the throat, chiefly of the palate, and will not be noted until there is a regurgitation of liquids through the nose as the child swallows; attempts at swallowing may be followed by spasmodic coughing from the liquid falling into the glottis. In this form of paralysis the muscles usually recover their tone in three or four weeks.

Any muscle or group of muscles may be involved, the eye, legs or arms. Cases of sudden death are most often due to a paralysis of the heart.

Diagnosis.—Considerable doubt may exist in one's mind as to the true condition existing in a case of membranous deposit

on the mucous membrane of the throat or nose, which can only be decided by a bacteriologic examination.

However in a case presenting a dirty-white membrane in the throat or nose which is not easily removed, a slight rise of temperature, enlargement of the lymph nodes, with evident prostration, as the element of time plays so important a rôle in treatment, it is safe to administer the antitoxin at once and confirm the diagnosis by bacteriologic examination later.

Follicular tonsillitis is more often mistaken for diphtheria. In this the tonsils are enlarged, but the edema of surrounding tissue is not so great, and if seen early the follicles containing the whitish deposit are discrete. It is later, when these coalesce over the surface of the tonsil, that the diagnosis is doubtful, but there is no tendency for the membrane to spread. When coalesced it can be more easily mopped off. The constitutional symptoms are more severe and the onset more sudden. The temperature is higher also. General aching is present as a rule even in young children, and they complain when handled. However, even though the diagnosis seems clear, especially when other children are in the house, a bacteriologic diagnosis should be made.

Quinsy.—A peritonsillar abscess may be confounded with diphtheria. In a case under my observation recently the consultant laryngologist believed the condition a diphtheria, but at my request endeavored to find pus by an incision, without success. Twenty-four hours later spontaneous rupture of the abscess occurred below the incision, which confirmed my diagnosis and cleared up all symptoms. There is very often an exudate over the affected tonsil and mucous membrane adjacent which can be removed without difficulty.

If but one side is affected the swelling is chiefly of that side, and the edema of surrounding tissue quite severe. The patient talks as if the mouth was full of mush.

Croup.—This form of trouble may be either catarrhal, false croup, or diphtheritic, true croup, and without visible membrane in the throat the diagnosis may be difficult. Direct inspection of the epiglottis is possible in the very young, but not in the

older children, and inspection by means of the laryngeal mirror is impossible in the child.

In catarrhal croup the child is awakened by a harsh, brassy, spasmodic, croupy cough, having been put to bed usually without anything having been noticed unusual in its condition. It may have had a slight evidence of "cold" in the head for a day or so previously. There may be some stridor, with evidence of obstruction to inspiration, but without recession, and but a slight rise of temperature. By morning, as a rule, it is comfortable, and but little cough is noticed, but when it does cough it is of the same brassy, harsh character. These symptoms have a tendency to recur for one or two nights subsequently. A few doses of ipecac, 20 or 30 drops of the syrup, or antimony and ipecac tablets ($1/100$ grain each), repeated at one- or two-hour intervals, a cold, wet compress to the throat and a steam-laden atmosphere for it to breathe, usually give relief in this form. It would be best to apply the term "croup" to the catarrhal form only.

After tonsillectomy the abraided surface is covered with a necrotic looking membrane, which resembles the diphtheritic membrane very much.

Prognosis.—This depends to a very great extent, in this day of antitoxin, to the promptness with which the diagnosis is made and the first injection of antitoxin given.

It depends greatly also upon the age of the patient. The younger the child the graver the prognosis. The site of the lesion also influences the prognosis. In purely tonsillar or pharyngeal cases the outlook is better, the nasal form less so, and the laryngeal cases very bad. The mortality in the laryngeal cases requiring intubation, even with the antitoxin, is very high.

Treatment.—In no disease has the mortality been so influenced as it has in diphtheria by the use of the diphtheria antitoxin. Statistics show the mortality has been reduced 50 per cent since the antitoxin era began.

Prophylaxis.—This is most important and is best accomplished by the medical inspection of schools; removal of diseased and enlarged tonsils and adenoids, strict quarantine of affected chil-

dren; careful disinfection of all bedding, clothes, feeding utensils and rooms vacated by those who have been affected; bacteriological examination of the throat before the child is dismissed, with a general bath after leaving the room; extreme care on the part of physician and nurse when entering and leaving the sick room, and the immunization of the children in the family or ward exposed to it.

Immunizing doses of antitoxin are usually advised as follows: for infants 300 units, 500 units for children up to 15 years, and 1000 units for adults. The immunity from this dosage lasts from two to four weeks. This dosage should be repeated if it is desired to prolong the immunity. Since the introduction of the concentrated form of antitoxin the complications formerly seen are less frequent, viz., the rash and severe urticaria.

After the child has recovered, the woodwork of the room should be first wiped down with a solution of 1:60 carbolic acid, and then disinfected with formaldehyd or formaldehyd and sulphur, or permanganate of potash.

Curative Treatment.—As soon as the diagnosis has been positively made, a curative dose of diphtheria antitoxin should be given. To a child of five years an initial dose of not less than 3000 units should be given. If the toxemia is severe, fever high, membranous exudate extensive, the dose should be 5000 units. Where no improvement follows within 8 to 12 hours a second injection should be made. In laryngeal cases the initial dose should not be less than 10,000 units.

A large number of reliable antitoxins are upon the market now and one should be chosen which is furnished in a sterilized syringe with sterilized needle and attachments.

The concentrated serums are preferable, as they less frequently cause the disagreeable rashes seen when larger volumes of blood serum were used.

The effect of the serum is usually prompt and decided. The temperature falls 1° F. or 2° F. within two or three hours, the child soon becomes tranquil and falls asleep. The most typical effect is that upon the membrane, within 24 hours it begins to curl up at the edges, and gradually peels off and becomes de-

tached either in its entirety or in places. The swelling and congestion of the mucous membrane become less marked.

The serum is best injected in the loose tissue of the back between the shoulders or in the loin. The advantage of this is the child does not see the preparations for the operation and is easily held while it is being done. Careful preparation should be made of the skin by soap and water cleansing, followed by alcohol, the sterile covering of the needle not being removed until everything is ready. The point of injection is covered by an inch-square piece of zinc oxide adhesive plaster, or sealed with collodion.

Complications Following Antitoxin.—More than 19 cases have been reported of sudden death following the use of diphtheria antitoxin. The cause of these fatalities has not been satisfactorily proven, but it is supposedly in cases of so-called status lymphaticus, and death occurs within a few minutes after the injection. Some exhibit alarming symptoms, sudden dyspnea, fainting, cyanosis and feeble, rapid pulse with recovery. These are believed to be phenomena due to the horse serum and not to the antitoxin it contains, von Pirquet's theory being that they are due to the antibodies.

Skin eruptions before the concentrated serum was used occurred quite frequently. These rashes were scarlatinaform or urticarial, when of the latter variety accompanied with great itching. Occasionally enlargement of the joints occurred. There is quite regularly a rise in temperature when these complications occur.

General and Medicinal Treatment.—Concentrated and nourishing food should be given, milk, in small quantities, and as often as every two hours; animal broths and beef juice. Gavage and rectal nourishment should be used if necessary. Enemata for constipation; hydrotherapy for temperature over 102° F.; sponge or tub baths. Stimulation is quite regularly indicated, and only a good bottled-in-bond whisky or brandy should be given. The quantity for 24 hours, half an ounce to an ounce, should be diluted with 2 or 3 parts of water, and this given at frequent intervals as indicated during the day and night. This can be supplemented by the hypodermic injection of strychnia

grain 1/200 to grain 1/100 according to the patient's age, or strophanthus by the mouth. The bowels should be specially watched.

Bromide and chloral, or Dover's powder, can be given in cases of extreme restlessness. Sedatives are usually indicated in the tube cases on account of the extreme restlessness from asphyxia and spasmodic coughing. Tonics following the attack are specially indicated.

Absolute rest in bed in a well ventilated room is the first requisite. It must be possible to effectually quarantine the sick room.

Local application of cold to the throat is beneficial in form of wet cold compresses or an ice bag.

Local Treatment.—Rarely is it necessary to use any local treatment in these cases after the injection of the antitoxin. The exhaustion following the struggle always accompanying swabbing of the throat is more harmful than if the throat is let alone. In the nasal form it may be necessary to irrigate the nose to open the nares. This is done by enveloping the child in a towel or sheet, holding it on its side on the nurse's lap, protected by a rubber sheet, and with fountain syringe containing a warm boracic acid solution or normal saline solution, one drachm to the pint, held 2 feet above its head, the upper nostril is irrigated, the solution returning through the lower one. With head slightly lower than the body there is no danger of the fluid being aspirated in the lungs.

INTUBATION.

To the late Dr. Joseph O'Dwyer of New York is due the perfection of the intubation tube for the relief of stenosis of the larynx. In 1883, after many months of trial and experimentation, Dr. O'Dwyer brought to the notice of the profession generally the intubation tube which he had perfected. It is due to Dr. O'Dwyer's memory to state that practically the only improvements that have ever been made in the tube were made by Dr. O'Dwyer himself before his death, the most perfect ones in use to-day being those made according to the O'Dwyer pattern. The tubes are made according to scale, usually in five sizes, corre-

sponding to the age of the child. They are made of metal, gold plated, and have a central swell which holds them in position, and a head and narrow neck which fits in the chink of the glottis.

In selecting the tube for the age of the child the scale is consulted, and the smallest tube which will remain in position is chosen. The tube reaches to within a short distance of the bifurcation of the trachea. The rest of the set consists of a mouth gag, with which the child's mouth is held open; and introducer,

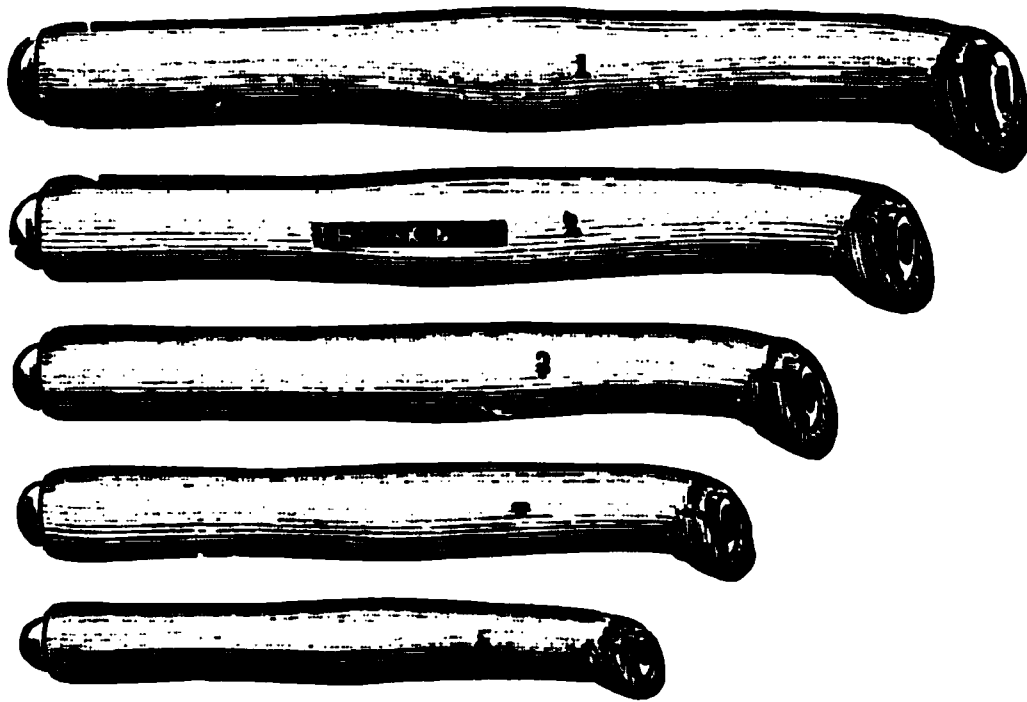


Fig. 77.—O'Dwyer Intubation Tubes.

upon the end of which is screwed the obturator, and an extractor or the extubator. In some of the late models of intubation sets each of the tubes contain an obturator easily attached to the shank of the introducer. Upon the side of the head of the tube there is a small opening into which is inserted a piece of thread long enough to reach beyond the mouth of the child in order to make it easy to remove the tube in case the opening becomes blocked with dislodged membrane, or if it has been pushed into the esophagus instead of the larynx.

Indications for Intubation.—An intubation tube is never introduced unless positive indications for its use are present. If in spite of the use of the diphtheria antitoxin the child has increasing asphyxia, evidenced by cyanosis and marked retraction of the spaces above the sternum and the clavicles, of the intercostal spaces and the epigastric region, it is imperative, in order to save the child's life, that a tube be inserted. Under these condi-

tions the patient is extremely restless, its respiration is very rapid and there is gradual deepening of the color to a deep cyanotic hue.

Operation.—O'Dwyer originally advocated the introduction of the tube with the child in an upright position, but it may be conveniently introduced with the child upon its back, with its chin slightly raised. The child should be wrapped carefully from shoulders beyond its feet in a sheet, thus confining its arms and legs. The child is held upon the right side of the lap of the nurse, its head resting against her chest, one of her arms encircling the lower part of the chest, the other steadying the head with hand upon the forehead. If enough resistance is at hand the nurse holding the child uses both arms to hold its body in position and the assistant steadies the head and holds the gag which has been introduced into the mouth. Many operators prefer to introduce the tube with the child lying upon its back, wrapped in a sheet as described.

After selecting the proper tube the thread is placed in position through the hole in the head of the tube and the intubator is examined to find if it can slip off the tube from the obturator easily. The thread is held firmly in the hand which is to be used to introduce the tube, the index finger of the unengaged hand is carried into the mouth and the epiglottis located and pulled forward, and the tube is then carried with the index finger as a guide directly into the larynx. With the attachment on the intubator the tube is slipped off its obturator and the obturator quickly withdrawn, the tube being pushed home by the finger still within the mouth.

As soon as the tube has been pushed home there is an instant change in the character of the cough. It now becomes harsh and brassy, and a good deal of spasmodic cough is caused. The child coughs more than it did before, and occasionally may cough up through the tube small pieces of membrane. After the first paroxysm of coughing the child usually falls into a sound sleep, the cough gradually lessens and the whole picture is changed.

Some advocate the leaving of the thread in the mouth, curling it up and placing it at the posterior margin of the tongue between

the cheek and the gum, but this usually proves very unsatisfactory. As soon as it is certain that the tube will not be coughed up the finger is carried into the mouth after reintro-



Fig. 78.—Position for intubation. First step.



Fig. 79 —Intubation. Second step. Introducer about to be removed.

ducing the gag and with the finger on the tube the thread is cut and slowly withdrawn.

The length of time it will be necessary for the tube to be worn varies very greatly. Some cases have been reported in which the tube could not be dispensed with before the end of

three weeks. It is well, as a rule, to allow the tube to remain in position for not less than five days, and if at the end of this time the fever has subsided and the respirations are normal it may be safe to remove the tube, having everything at hand necessary for its reintroduction in case a spasmodic condition arises again, necessitating its reintroduction.

Extubation.—After close watching of the patient it is decided that the tube can be removed, the child is prepared as for intubation. The gag is inserted, the index finger carried to the tube



Fig. 80.—Position for feeding child wearing intubation tube.

and the extractor with beak closed is carried down to the tube along the finger as a guide, placed in the opening, thumb is depressed, beak opened and by lowering the hand the tube is withdrawn.

Feeding.—During the wearing of the tube it is very necessary that the child be fed in the recumbent position, with its head well over the edge of the bed, or the nurse's lap, and below the level of its body. Usually the child is very easily fed in this position, and will either take its milk or food from a spoon or a bottle. This position was first suggested by Dr. Cassellberry of Chicago, and has been of very great service. Only liquids should be given until the tube is removed.

This operation has practically entirely superseded the old operation of tracheotomy, which is the making of an opening in the trachea immediately below the cricoid cartilage.

INCUBATION AND QUARANTINE IN CONTAGIOUS DISEASES.

The following is the report of the Committee on Quarantine of the Medical Society of the County of Dutchess (New York), embracing suggestions regarding periods of incubation and quarantine in contagious diseases, and are reproduced because of their conciseness:

Small-pox.

Small-pox is considered the most infectious of all diseases. Period of incubation 1 to 10 days in the great majority of cases; shortest time $5\frac{1}{2}$ days, longest time 16 days.

Prophylaxis.—Vaccination, revaccination and isolation. Vaccination may render one immune to the disease up to the fourth day after exposure.

Quarantine should continue until all the affected epidermis is removed—the dried discs and scales containing infectious material. Each case is one unto itself, and no definite time other than stated can be given.

Diphtheria.

Period of incubation, 24 hours to 7 days.

Prophylaxis.—Isolation, disinfection, antidiphtheritic inoculation. Plenty of fresh air.

Quarantine should continue until at least two cultures from the throat prove negative to the diphtheritic bacillus by bacteriological examination.

Measles.

The second most infectious disease with which we have to deal. Period of incubation, 9 to 11 days.

Prophylaxis.—Isolation during whole course of the disease.

The disease may be transmitted from the first symptoms until after the desquamation, but as the eruption begins to fade the danger of transmission diminishes, and during the period of desquamation the probability of transmission is but slight. This point, however, is a mooted one. The rule is isolation until the skin is perfectly clear and normal, and there are no nasal or aural discharges.

Scarlet Fever.

Scarlet fever is considered the third most infectious disease.

Incubation.—As short as 24 hours; as long as 21 days; average, 7 to 12 days.

Prophylaxis.—Isolation for a long time, at least until desquamation has entirely disappeared and the skin is in its normal healthy state, and there are no nasal or aural discharges. Proper disinfection and hygienic conditions must exist during whole course of the disease. Desquamation in this disease is infectious as well as the discharges. Serum therapy has not been of any avail in this disease.

German Measles.

Period of incubation from one to four weeks, average time 14 to 21 days.

May be transmitted by contact and by fomites. Contagion seems to differ in different epidemics. The best authorities state that the contagiousness disappears with the eruptions, therefore isolation should be enforced until the eruption has entirely disappeared.

Whooping-Cough.

Transmitted by direct contact.

Infection begins with the earliest symptoms.

Period of incubation from one to two weeks.

Prophylaxis.—Isolation until at least the “whoop” has disappeared.

Cerebrospinal Meningitis.

Transmitted or communicated through secretions of the mouth, nose and conjunctivæ, but it has not been determined whether the disease is communicated to human beings by insects.

Period of incubation from a few days to three weeks.

Prophylaxis.—Isolation, disinfection. Isolation should continue until the mucous membranes are free from meningococcus or the diplococcus (meningitidis) intracellularis. Serum therapy has been used successfully in some cases.

Chicken-Pox.

Period of incubation four days to a week.

Prophylaxis.—The person infected should be isolated during the entire eruption period and until the removal of the scabs.

It must be considered as among the most contagious diseases, but the mode of infection is not given.

Mumps.

Period of incubation 4 days to 24, average two weeks.

Prophylaxis.—The disease is transmitted even before the symptoms appear, and even as long as six weeks after the symptoms have disappeared.

DISINFECTION.

In all cases of infectious or contagious diseases, all utensils, bedding, toweling and clothing of every kind should be thoroughly disinfected and fumigated. Utensils, by the use of formalin, carbolic acid, creolin or bichloride solutions, care being taken that bichloride solutions do not come in contact with metal. All dejecta by the use of formalin, copperas or persulphate of iron solutions. Bichlorides are not recommended for use in dejecta as an albuminate is formed on the outside, and proper sterilization is therefore prevented. All bedding should be saturated in a formalin solution or one of bichloride solution before being sent to the laundry. Where there are proper facilities, all bedding, of whatever nature, should be thoroughly sterilized by superheated steam or by dry heat, especially this should be done with all mattresses. In institutions where this cannot be done the mattresses and all bedding should be destroyed. The same should hold for private practice, but inasmuch as this procedure in private practice would work a hardship to a great many poor people the physician will be able, by thorough formalin disinfection and fumigation, to prevent the spread of the disease. The bedding, however, should be thoroughly saturated in a solution of formalin sufficiently strong to be effective. The wind will clear out the fumes.

More care in the isolation and quarantine for measles, scarlet fever and whooping-cough should be exercised, because there is no known medical treatment to cut short the course of, or to render people immune to these diseases. With diphtheria and small-pox the old pest-house idea should be abolished, inasmuch as every one coming in contact with these two diseases may be rendered immune by the proper use of vaccine virus and serum therapy; the same is probably true of cerebrospinal meningitis.

CHAPTER XVII.

DISEASES OF THE CIRCULATORY SYSTEM.

THE HEART.

EXAMINATION, DEFECTS, DISEASES.

The heart is placed more horizontally in the chest of the child, and the apex beat is higher. During the first five or six years it is found in the fourth interspace, and slightly to the outer side of the mammillary line, and it gradually becomes lower as the heart enlarges, until it is found in the fifth interspace. The outline can be made out by percussion with ease, because of the thinness of the chest wall, and for this reason light percussion is necessary. The relative dulness extends from the right border of the sternum to beyond the left mammillary line.

The pulse rate in the infant and child varies with the age and at different times of the day and under varying conditions. The following rates may be considered average for various ages:

Newborn	120 to 160
First 12 months.....	100 to 120
Second year	90 to 100
Third to fifth year.....	90

The blood pressure is not at all constant nor can it be considered a very valuable aid in pediatrics. The following rates of blood pressure have been given for various ages:

Infancy	75 to 90 mm
Children	90 to 100 mm
Young adults	100 to 135 mm

An examination of the heart should include careful inspection, palpation, percussion and auscultation. From *inspection* we learn, in most cases, the location of the apex beat, the presence

or absence of dyspnea, and the character and frequency of the breathing; color of the skin and nails; position of the patient; shape of the finger tips; the size of the liver and spleen, and the amount of gaseous distention of the abdomen. From *percussion* the relative area of dulness of the heart, size of liver, condition of the lungs, back and front. The finger is the best pleximeter and the hand and fingers the best percussion hammer. By *palpation* the apex beat can be located and its force determined, also the character of the pulse. It can be learned whether the pulse in the two wrists beats with the same volume, the frequency of the pulse and the character of the pulse wave. From *auscultation*, the character of the sounds of the heart, the presence or absence of murmurs or a bruit or friction sounds; character of the breathing and of adventitious sounds.

Defects of the heart are frequently found at birth, the *congenital heart lesions*, which may either be the result of imperfect development or the persistence of fetal structures, as a patent foramen ovale, or a stenosis of the pulmonary or mitral orifices. Stenosis of the pulmonary orifice is usually due to fetal endocarditis.

The heart lesions, as the result of *disease*, are usually endocardial, and caused by the infectious diseases, with their organisms and toxins.

Because of the peculiar susceptibility of the heart muscle and its lining membrane to bacterial invasion, and the influence of their toxins, the changes incident to these complications in the infectious diseases as in typhoid fever, scarlet fever and diphtheria are greatly to be feared.

The chief disease at fault is *rheumatism*, and, as mentioned in the section on that subject, a rheumatic heart may be present with but few or no joint lesions, the heart being practically the only manifestation of the disease.

Scarlatina and *diphtheria* cause serious heart lesions, mostly due to the effect of the complicating organism, the usual one being the streptococcus. *Influenza* as a cause of acquired heart disease is not generally believed, but I have seen it. Among the predisposing causes may be mentioned the seasons, violent physical exercise, anemia and chorea.

CONGENITAL HEART DISEASE.

The most frequent form of congenital heart disease is the permanent *patency* of the *foramen ovale*. *Congenital valvular lesions* are also found, the chief being of the pulmonary orifices, as the right side of the fetal heart is more frequently involved than the left. The opening into the aorta is rarely affected, though it may be. A number of other congenital lesions have been found post mortem, among them being, impervious or contracted auriculo-ventricular orifices; impervious or absent aorta; continuance of ductus arteriosus after birth; transposition of aorta and vena cava.

Symptoms.—The chief symptoms of the congenital form of heart disease is the early cyanosis and the heart murmur.

The cyanosis is quite marked, especially when the child cries, the skin and nails and mucous membranes are blue, and the name applied to these blue babies is *morbus ceruleus*.

Bronchitis and *bronchopneumonia* are not at all infrequent in these cases from passive congestion, and principally involve the posterior border of the lungs. Clubbed fingers and toes are often seen. These children are backward mentally and physically.

Dyspnea and *orthopnea* are frequent, and the pulse is much increased in frequency. With rupture of compensation edema of the lower extremities takes place.

Diagnosis.—The diagnosis of pulmonary stenosis is made principally from the physical signs. The presence of a heart murmur and enlargement of the heart can be easily made.

The murmur is systolic in character and as a rule harsh and loud, and heard distinctly over considerable area. The exception may be true, a soft-blowing murmur may be heard. It is heard usually best at the base and transmitted upward. No murmur may be heard.

Auscultation may prove very unsatisfactory in regard to a correct diagnosis of the seat of the lesion. I recall one case in which a number of examinations were made by experienced diagnosticians, and numerous opinions given, and none was correct, as shown by the autopsy findings.

A systolic murmur in the center of the precordial area not transmitted is suggestive of a patent foramen.

Prognosis.—This is always grave, since children with congenital heart lesions, the blue babies, rarely survive the second year. They may be well developed at birth, but soon become anemic, athreptic and emaciated. As a rule they do not reach puberty. Stoelker gives 193 cases, 24 died in first six months; 42 before the end of the first year; 56 before the tenth year, and 71 before the twentieth year.

The degree of cyanosis and dyspnea influence the prognosis. If these children can be placed in proper surroundings in regard to home life, climate, etc., the prognosis is better. They are susceptible to pneumonia, especially due to the passive pulmonary congestion.

Treatment.—The treatment is unsatisfactory as far as cure of the condition is concerned. It is largely symptomatic, with a general supervision over the diet, exercise, habits and clothing of the child. It should have tonics and nourishing food, which will not cause an attack of indigestion, and should be guarded against the contagion of the exanthemata and pulmonary diseases. Its clothing should be warm and changed according to the seasons, and in winter, if possible, it should be taken to a warmer, more equable climate, where an out-of-door life in the sun can be led. The exercise must never be violent, but under supervision. If digitalis is given as a heart tonic it should be in small doses, and increased in the presence of ruptured compensation. Strychnia or strophanthus are valuable adjuvants in an emergency. Oxygen for extreme cyanosis is of benefit.

PERICARDITIS.

Definition.—This is an inflammation of the serous membrane enclosing the heart, the pericardial sac.

Forms.—It occurs as an acute condition, and two forms are recognized, the dry pericarditis and pericarditis with effusion.

Etiology.—**Dry, Fibrinous, Plastic.**—It is most frequently a secondary condition to a general infectious disease. The bacteria localized by Flexner are chiefly the micrococcus lance-

olatus, streptococcus, staphylococcus aureus, bacillus pyocyaneus, influenza bacillus and the tubercle bacillus. Rheumatism has long been looked upon as a cause, and it may occur both during the attack and a number of days after the subsidence of the acute rheumatic symptoms. Babcock mentions nephritis as a cause of pericarditis not often thought of. Trauma is also a cause.

Pathology.—The smooth serous membrane is injected, there is an endothelial desquamation and the surface is roughened from a fibrinous exudate. Serofibrin or serum may be thrown off, enough to separate the two layers, but they may adhere and form fine fibrous bands or a more dense and firm set of adhesions. A myocarditis may also be present.

Symptoms.—This condition may pass unrecognized unless an examination of the heart is made. Suspicion may be aroused by the rise of temperature, which follows beginning inflammation of the pericardium.

Pain is rather a constant and prominent symptom when the child is old enough to localize it. It may be referred to the precordial region, the epigastrium or even between the shoulders. As a rule it is not very sharp, but it may be very acute.

The *temperature* is quite regularly elevated, to 102° F. or perhaps more. The presence of a rise in temperature, in any of the exanthemata or rheumatism, should cause the heart to be investigated.

The *pulse and respirations* are both accelerated. There may be some cough, and loss of appetite is usual.

Physical Signs.—The prominent physical signs are those caused by the roughened pericardium, viz., friction fremitus and friction sounds. Deep pressure by the palpating fingers may decrease the fremitus felt on light palpation. The friction sound is usually best heard over the middle of the precordium, on both systole and diastole. The area of heart dulness is increased, quite decidedly so if there is any effusion. The heart sounds are apt to be somewhat muffled.

Occurrence.—Poynton¹ gave some statistics of heart disease in children as follows: “Of 150 fatal cases of rheumatism heart

¹ Babcock: *Diseases of the Heart*.

disease, there was evidence of more or less acute plastic pericarditis in all but nine. In 113 the pericardium was more or less adherent, while in 77 the adhesion was complete.”

Diagnosis.—From endocarditis by the absence of murmurs and the presence of friction sounds, pericarditis with effusion, the apex beat is displaced or absent. In pleurisy with effusion the apex beat may be displaced, but the area of flatness is much greater.

Prognosis.—This is always grave. Occurring as a complication of rheumatism or of any of the exanthemata, it is especially so.

Treatment.—This is largely symptomatic, as there is no method of aborting the trouble. The heart condition is benefited by the use of remedies to combat the underlying disease, active antirheumatic remedies should be used freely when that disease is present.

Application of an ice bag is of great assistance. A small and light one is used, and not completely filled. A piece of flannel is placed between the skin and the ice bag, gradually increasing the length of time until it is worn continuously. At first it is kept on for a few minutes then removed for a short interval. Hot applications can be used but not with the same benefit.

For the pain, discomfort, dyspnea and nervousness opium is of benefit. Heroin may also be used. Hydrotherapy may be needed for the temperature, if it goes much above 102° F. The ice bag has a tendency to keep the fever down.

Digitalis should not be given unless positively indicated, rather give strychnia as needed.

PERICARDITIS WITH EFFUSION.

The exudate in this form may be serofibrinous, purulent or hemorrhagic. Its character cannot be determined unless an exploratory puncture is made.

The *pathology* of these conditions is largely the same as the dry pleurisy, until the effusion takes place.

Symptoms.—The early symptoms before the effusion are those of the plastic or dry pleurisy, pain, slight cough, restlessness,

rise of temperature and pulse, etc. As the effusion takes place the pain is relieved, and the symptoms then presenting are chiefly those of pressure.

The sac is distended and the area of heart dulness is changed in shape, the rounded apex of the triangle being upward. The heart is displaced if the quantity of effusion is large, the apex beat being found to the outside of the left nipple, as a rule.

The pulse is usually regular but compressible. It may be intermittent.

Rotch¹ has suggested that a small triangular area of dulness is found at the lower right corner, which is easily made out.

Prognosis.—Depends upon the characters of the fluid which is contained in the sac. The hemorrhagic form is usually quite rapidly fatal. Owing to the serious myocardial changes which may take place the prognosis in children is specially bad.

Treatment.—Practically nothing can be done to mitigate the condition other than has been recommended in the previous section. Rest, ice bag, blood letting, etc. The special indications are absolute rest in bed, opium for pain and restlessness. Salines by the mouth occasionally and aspiration when it is indicated.

Aspiration is done without much discomfort. The needle is introduced preferably in the fifth interspace, between the nipple line and the sternum border, and between the apex beat, if it can be located, and the lower border of the effusion, as shown by the flatness, all the fluid which can be removed being allowed to escape. If many pressure symptoms are present surgical interference is imperative promptly.

Digitalis is used when indicated only. The fat-free tincture in 5 or 10 drop doses is the best preparation, and used for its effect. If diuresis is specially desired the infusion of digitalis may be given with decided benefit, a teaspoonful to a dessertspoonful every three hours.

Sleep may be insured by chloretone, in 2 or 4 grain doses. Codeine, gr. $\frac{1}{4}$ to $\frac{1}{2}$, especially indicated if there is any cough present; atropia if there is much dyspnea.

¹ Rotch: Pediatrics.

CHRONIC PERICARDITIS.

The process in this variety of pericarditis may be limited to the pericardium, or extend through to the tissues of the mediastinum. In the latter form there are usually adhesions, more or less dense between the pericardium and the mediastinal tissues.

Pathology.—As a result of the inflammatory process there is a new connective tissue growth, if intrapericardial, principally between the base of the heart and pericardium. Associated with the external pericarditis an inflammation of the adjacent pleura may take place, with adhesions between pericardium and pleura. Rarely an effusion may be present in this form.

Etiology.—Tuberculosis is usually the cause of the chronic form, and it may follow the recurrence of the acute form. It is not very common in children.

Symptoms.—There may be no special symptoms, save perhaps dyspnea on exertion, and when secondary heart changes take place, edema, ascites, cough. Physical examination may not reveal any distinctive signs whatever in connection with the heart, but may reveal the presence of an hepatic engorgement. Nothing may be found during life whereby a positive diagnosis can be made, but at the postmortem the adhesions are found.

Treatment.—This is entirely symptomatic. The engorgement of the liver must be treated by appropriate remedies.

PYOPERICARDIUM.

This is a very rare and fatal condition.

Etiology.—It is oftenest due to a general pyemia, as may occur from otitis media, osteomyelitis, etc. In young children it may occur as a complication of pulmonary disease, notably empyema, and due directly to the pneumococcus. Sex plays no part in its causation. In 100 cases reported by Poynton¹ 83 per cent occurred before the fourth year, and two-thirds between the ages of one and three years. The exanthemata are predisposing causes.

Pathology.—The fluid found in the pericardium varies from fibrinopurulent fluid to a creamy pus. The pericardium is thickened and adhesions frequent.

¹ British Medical Journal, August 15, 1908.

Symptoms.—The beginning of the pericardial infection cannot be accurately told, as the friction sounds usually present in pericarditis are not nearly as often present as in the other varieties of pericarditis.

This form may be acute, lasting several weeks, or chronic, running a much longer course.

The child is ill from the beginning, dyspnea is prominent. The temperature is elevated and irregular, the pulse feeble and rapid.

The usual signs are present if the effusion is large in amount. Muffling of the heart sounds; increased dulness over the precordial region, especially upward toward the left clavicle.

Prognosis.—These cases are almost universally fatal, and many come to autopsy without the diagnosis having been made.

Treatment.—Supportive treatment and paracentesis of the pericardium offers the only hope of cure. The left lower margin of the cardiac dulness has been recommended as the point of selection.

ENDOCARDITIS.

Definition.—An inflammation of the lining membrane of the heart, the endocardium, affecting chiefly that portion forming the valves. In fetal life it is the right side which is oftenest affected.

Etiology.—The active cause of endocarditis is bacterial, and it occurs rarely as a primary affection, more often as a complication, or as Babcock terms it, a *manifestation* of rheumatism, diphtheria and any of the acute exanthematous and infectious diseases. By far the most frequent causes are rheumatism and chorea, the following also being causes: tonsillitis, influenza, cerebrospinal meningitis, typhoid fever and septic infection.

Pathology.—The endocardium becomes cloudy, swollen and injected, with a chief pathologic process taking place in the valves, which are folds of endocardium. At the point of greatest strain there may be a break in the surface of the valve, and a deposit of fibrin at once takes place, becomes organized and forms what are called vegetations. These may be broken off, taken up by the circulation and form emboli, causing infection

in remote organs. Staphylococci, streptococci and influenza bacilli may be found.

Symptoms.—Many cases of endocarditis present so few symptoms that they go unrecognized, and the fact that the inflammation has occurred is only determined by a chance physical examination of the heart. Realizing the frequency of the occurrence of this manifestation, careful and regular and frequent examinations of the heart should be made during the course of every illness in a child especially when due to infectious diseases and rheumatism.

There may be a sharp rise in the temperature which has been on the decline, previously, and with it pain in the region of the heart and dyspnea or air hunger,¹ and palpation.

Physical Signs.—The pulse shows a tumultuous action, ill sustained and frequent, and a throbbing of the vessels of the neck. The heart sounds are roughened or muffled and there is practically always a distinct blowing murmur heard over the precordia with the point of intensity varying according to the valve involved. The murmur may entirely take the place of one of the sounds.

Prognosis.—The course of a simple or rheumatic endocarditis is toward recovery, but with the heart left in a crippled condition, a leaky or an obstructing valve. Cases have been reported with complete recovery, without a permanent crippling of the valves. Compensation may always exist, and the patient succumb to any other condition. Poynton points out the frequency of an inflammation of the heart muscle in fatal endocarditis. If a vegetation is washed off in the blood current and an embolus result, the prognosis is influenced according to the location of its lodgement. If in the brain, the outcome is serious, if not as to life, certainly as far as permanent recovery is concerned.

Treatment.—With the first evidence of chorea or rheumatism, the child must be put to bed at once and absolute rest in bed maintained throughout the attack. At the first evidence of pain in the precordial region an ice bag should be applied, with a light piece of flannel between it and the skin. Heat in exceptional cases may be more acceptable.

¹ Babcock.

The treatment is largely symptomatic, pain is controlled by opium in some of its forms; bromides for the restlessness, and salines and calomel when indicated.

The remedies which should be avoided are digitalis, aconite, veratrum viride and all of the coal-tar products. Digitalis increases systole and throws more strain on the valves; veratrum and aconite depress the circulation too much, as do the coal-tar products.

Strychnia is a valuable agent later, after the acute symptoms have subsided.

As a routine the administration of the salicylates is advisable. Aspirin is well borne.

The diet should be the most easily digested, those foods which have a tendency to form gas which would cause pressure symptoms should not be given at all.

MALIGNANT ENDOCARDITIS.

Synonym.—*Acute ulcerative endocarditis.*

Definition.—This condition is an inflammation of the endocardium and occurs as a manifestation or complication of general septic troubles, and is rather infrequent in children.

Etiology.—This is essentially a septic condition due to the action of the pus-producing organisms in the endocardium, of which the most commonly found are streptococci, staphylococci, pneumococci and diphtheria bacillus. The process is more apt to be engrafted upon an endocardium previously inflamed.

Pathology.—In children, in whom ulcerative endocarditis is comparatively rare, the process is the same as in adults. There is an exaggeration of the condition found in simple endocarditis. As its name implies, there may be an ulcerative condition affecting chiefly the valves, and emboli are more apt to occur. These emboli are vegetations full of the infecting organisms, and a similar process begins wherever they lodge.

Symptoms.—The symptoms are those of a general septic condition, and unless a special examination is made of the heart, attention at first is not called to this part at all. The patient is in a typhoid state. The fever is usually decidedly intermit-

tent in character and inclined to be irregular, perhaps preceded by a chill, frequently reaching high, 105° F., or over. The skin is hot and dry, except during the free sweats, which are apt to be a feature; the tongue dry, the bowels loose, loss of appetite, the pulse weak and often much accelerated. The patient looks profoundly impressed by something and the anemia is progressive.

The physical signs may be very indefinite, perhaps a blowing murmur, perhaps none. If the patient develops symptoms of a septic nature, following on a simple endocarditis, the diagnosis is usually plain.

Prognosis.—The prognosis is grave, nearly all cases dying promptly.

Treatment.—Beyond removing the cause of the general septic condition, if possible, a nutritious diet, judicious stimulation and rest, there is little that can be done. The antistreptococcic serum might hold out some hope of relief.

CHRONIC ENDOCARDITIS.

The form of endocarditis usually referred in children to which the term chronic is applied, is that which follows the acute endocarditis.

Pathology.—The process following an acute endocarditis is that of repair, an absorption of the vegetations on the valves and the formation of connective tissue. This may result in a deformity of the valves preventing their perfect closure, allowing a backward flow of the blood, a *regurgitation* or *insufficiency*, or an interference to the free flow of the blood through the valve, a *stenosis* or an *obstruction*.

If the heart muscle develops in proportion to the dilatation of the heart cavities, resulting from the overwork because of the obstruction at the valvular orifice or a damming back of the current, a compensation exists. As long as compensatory hypertrophy exists practically no symptoms are present, and unless the chest is examined it may go unrecognized.

The symptoms of ruptured compensation are practically the same in all the valvular lesions.

MITRAL REGURGITATION.

In this condition the mitral valves are incompetent to hold the blood of the left ventricle from regurgitation into the auricle during ventricular systole.

Pathology.—The cusps may be so stretched as to overlap and allow leakage; one valve may be contracted following the deposit of fibrous tissue. The left auricle receives blood from the lungs and from the ventricle at systole, consequently it quickly becomes dilated, and because of this crowding it is hypertrophied in its attempts to empty itself. When this compensation exists no trouble results, but when the auricle is overpowered the blood dams back upon the lungs and serious symptoms supervene, passive congestion in many important organs resulting. This condition is a very common one among children.

Symptoms.—Practically no symptoms exist during the maintenance of compensation. There may be a visible difficulty in breathing on violent exertion, such as running or rushing up steps, with a coincident increase in the pulse rate. Children, however, rarely complain of this, and unless they evidence some pallor after taking this undue exercise, it may not be recognized. These children may develop colds more readily, and owing to the strain upon the right side of the heart on coughing this symptom should be closely watched.

With rupture of compensation and the general passive congestion there is bronchitis; catarrhal gastritis; enlargement of the liver; engorgement of the hemorrhoidal vessels; nephritis; cyanosis and dyspnea. Dropsy is one of the last symptoms to develop.

Physical Signs.—*Inspection.*—With the chest bared the apex beat is found displaced downward and to the left, owing to the left ventricular hypertrophy. If the right ventricle is enlarged, epigastric pulsation may be noted.

Percussion shows an increased area of heart dulness.

Auscultation.—There is a systolic murmur, or bruit, loud and blowing, and heard most distinctly over the apex beat. It is transmitted under the arm and posteriorly to the angle of the scapula. It is synchronous with the first sound of the heart,

and it may take the place of the first sound entirely. The second sound is accentuated.

Prognosis.—This depends entirely upon the existence of compensation. It is always grave when compensation ruptures.

MITRAL STENOSIS OR OBSTRUCTION.

This is an interference to the flow of blood from the auricle into the ventricle, and is usually due to an endocarditis.

Pathology.—The obstruction may be caused by a deposit on the valve or at the valvular orifice, narrowing the orifice in either event. In consequence the auricle is dilated and hypertrophied, and the left ventricle is relatively smaller in size. A right ventricular hypertrophy takes place from increased work thrown upon it by passive congestion of the lung. This lesion is less frequent in children than in adults.

Symptoms.—There are very few symptoms in the absence of ruptured compensation. Dyspnea is present on the slightest exertion, digestive disturbances are common, and these children are below par physically. There may be pain in the region of the heart, cough may be present, edema develops early, congestion of the kidneys follows, and then ascites. Cyanosis of the skin and nails develops also.

Physical Signs.—*Inspection.*—A distinct impulse may be seen at the base, with feeble apex beat, which may be but slightly displaced outward. Clubbing of the fingers is quite noticeable.

Palpation.—An important sign is thus elicited, the *presystolic thrill* being felt. This is a distinct thrill, felt in the fourth and fifth interspaces, just before the ventricles contract, inside the mammary line; a pulsation can also be felt in the epigastrium. The pulse is of less volume than normal and slowed, and the left radial may be found the weaker. *Percussion* shows an increased area of dulness downward and to the right.

Auscultation.—There is a presystolic bruit, heard with greatest intensity above and to the right of the apex beat, and not transmitted. The murmur is much rougher and harsher than the regurgitant murmur. The sounds of the heart are normal, except perhaps an accentuation or the reverse of an indistinctness of the pulmonary second sound. Babcock describes a

...of the ... limited to the mitral area, or the ...

Prognosis.—This is one of the graver of the valvular lesions. The child is stunted in its growth and from five to ten years may be the limit of its existence. Pulmonary complications are usually the cause of death.

AORTIC REGURGITATION.

Synonyms.—Aortic insufficiency, incompetency.

In this condition the left ventricle can never completely empty itself as the aortic valves are incompetent to prevent the blood flowing back immediately into the ventricle during diastole.

Pathology.—In children the condition is due to an endocarditis, is inflammatory, and as a result the cusps are contracted or held down by bands, making perfect closure impossible. Vegetations may be so placed on the edge of the valves as to prevent closure.

In this condition an enlarged left ventricle is the first change noted, and as it enlarges it may cause an incompetency to develop in the mitral orifice. Compensatory hypertrophy occurs early, and the wall of the ventricle may be very thick, 1 or 1½ inches thick. This heart is called the beef heart or *cor bovinum*.

Symptoms.—As in the other conditions, as long as compensation exists, there may be no special symptoms. Palpitation is not infrequent and may be the only symptom. It is to the pulse one must look for rupture of compensation. It becomes weaker, and the typical Corrigan pulse is felt if the child's hand is elevated above its head. The pulsations are not even or regular.

Physical Signs.—*Inspection.*—Visible pulsation may be noted in the larger arteries of the body, notably the carotids, but this is not as frequently seen in children as in adults. The apex beat is displaced downward perhaps as much as two spaces, and outward.

Palpation.—The cardiac impulse is quite strong, the heart's action being tumultuous. The characteristic *Corrigan* or *water hammer* pulse is present. In this phenomenon the child's hand being held higher than its head, the finger on the radial artery

feels the strong pulsation, and the artery immediately collapses.

Percussion.—This shows the extent of the enlargement of the heart, the area of dulness extending farther downward and to the left than normal.

AORTIC STENOSIS.

This lesion is more rare in children than in adults, being quite infrequent in adults.

There is a narrowing or obstruction of the orifice of the aortic valve.

Pathology.—As in the mitral stenosis there may be adhesions holding the valves to prevent their closure, and at the same time obstructing the flow, and vegetations may narrow the opening. Congenital narrowing of the orifice and aorta itself may rarely be present. From overwork in forcing blood through a constricted opening, the left ventricle is enlarged and hypertrophied. As a result of beginning rupture of compensation the left auricle becomes enlarged from forcing blood into a partly emptied ventricle.

Symptoms.—As a rule more serious symptoms are present in this form of valvular lesion than any other, though, as in the others, no symptoms may be present. With beginning rupture of compensation the child is anemic, incapable of the least exertion, either mental or physical, and is dyspneic.

Mitral regurgitation frequently occurs as a complication of aortic stenosis.

Physical Signs.—*Inspection.*—Displacement of the apex beat downward and outward owing to the enlargement of the left ventricle.

Palpation.—A systolic thrill may be felt at the base, along the course of the aorta especially. The pulse is weak because of the lessened volume of blood filling the artery. The artery does not fill with each pulsation.

Percussion.—This only confirms the enlargement of the left ventricle by the area of dulness being displaced downward and to the left.

Auscultation.—Over the aortic, or second right interspace, there is a systolic murmur heard with the first sound, and trans-

mitted upward in the great vessels of the neck. It may follow the blood stream down the aorta and be heard between the scapulæ.

Prognosis.—Depends on the amount of compensation or rupture of compensation. The prognosis is serious. Death does not occur suddenly in this form.

TRICUSPID REGURGITATION.

This is the principal right side heart lesion, and is chiefly the result of fetal endocarditis.

Pathology.—The right ventricle and auricle are enlarged and the walls of both are thinned. There are usually other valvular lesions associated with this form.

Symptoms.—Cyanosis and swelling of the veins of the face and extremities is an early manifestation of this damming back of the venous blood current. The congestion extends to the abdominal viscera, the liver and the hemorrhoidal plexus of veins are enlarged. The child is incapable of exertion, and when it cries there is an evident cyanosis. Dropsy of the extremities may develop. Hydrothorax may occur.

Physical Signs.—*Inspection.*—Enlargement of the veins of the neck are quite prominent, and in the event of ruptured compensation jugular pulsation is seen.

Palpation.—The venous pulse can be felt; also one in the liver if this organ is palpated.

Percussion.—Increase in area of cardiac dulness to the right and even below the ensiform cartilage.

Auscultation.—A blowing, systolic murmur is heard best over the tricuspid interspace, second left. It may also be heard loudly at the ensiform cartilage.

Prognosis.—This is relatively grave, more so if associated with lesions at other orifices.

TRICUSPID STENOSIS.

This is a very rare and practically unknown condition in children. Babcock¹ refers to only 1154 cases which have been recorded in medical literature.

¹ Babcock: Diseases of the Heart and Arterial System.

Pathology.—The same morbid anatomy exists as in mitral stenosis.

Etiology.—A fetal endocarditis in congenital cases and rheumatism in those developing after birth. The most recorded cases occur between 20 and 30 years, and more females affected than males.

Symptoms.—The majority of cases evidently go unrecognized. Visceral engorgement is the principal manifestation.

Physical Signs.—Palpation shows the pulse weak and variable.

Auscultation.—Like the other physical signs the sounds are indefinite. A presystolic murmur may be heard in the tricuspid area.

COMBINED VALVULAR LESIONS.—Any two or several of the valvular lesions described may be associated in the same individual, as mitral stenosis and aortic regurgitation; a double mitral lesion; mitral and aortic stenosis, etc.

PROGNOSIS IN VALVULAR LESIONS.—As noted, there is usually no immediate danger in cases of valvular lesions in children, but because of the secondary symptoms produced, these children do not do well, do not thrive. Compensation fails sooner or later and they rarely live beyond young adult life.

THE TREATMENT OF VALVULAR LESIONS.—The physician should have control of the child's habits of life, its diet, exercise, clothing and sleep. The amount allowed of each depends largely on the presence or absence of compensation. If compensation exists the whole effort of treatment is to maintain it. The exercise must be under supervision. The nurse or companion should notice carefully for over-fatigue, symptoms of dyspnea or pallor, and stop violent play at once. Mitral stenosis demands more care than any of the rest. Young boys should be warned and, is possible, prevented from using tobacco. The clothes should be prescribed, not too light, but warm and protective. Bathing to obtain an active skin is most important. The diet should be so regulated that no residue for fermentation is left in the bowel and stomach. Any intercurrent disease must receive careful attention, especially epidemic influenza and tonsillitis.

Too much emphasis cannot be placed upon the importance of

digitalis, both as a poison and a drug of value. Too many physicians use this drug as a regular and routine remedy, no matter whether the indication is present or not. It is capable of doing great injury, and should be used only when a positive indication presents. With compensation present, digitalis is not indicated.

Laxatives should be used when indicated and the formation of toxins and intestinal gases prevented if possible.

When *rupture of compensation* exists, active and judicious treatment is indicated. Every condition which interferes with proper aëration and nutrition should be removed. If adenoids are present they should be removed, if a gastric catarrh is present it should receive attention, diet should be so regulated that no fermentation takes place.

Digitalis, in the presence of ruptured compensation, is of great value, the fat-free preparation being prepared. *Strophanthus* may be used instead. *Strychnia* is of value as a remedy and its effect noted carefully. Its cumulative effect has been observed with muscular twitchings prominent.

For *pain* in the primary or recurrent endocardial inflammation, opium in some form is indicated, either as codeine or heroin.

Rest is an important aid in the treatment, special symptoms are treated as they arise.

FUNCTIONAL DISORDERS OF THE HEART.

Neuroses of the heart in an otherwise normal heart are not common in young children. The two conditions most often met are *bradycardia* and *tachycardia*.

BRADYCARDIA.

This is an abnormally slow pulse rate, below 60 pulsations per minute. Very rarely the pulse may be found normally much slower than 60. Several in the family may have a slow pulse.

Etiology.—Heredity may be a factor in its causation. It has been noticed to occur in masturbation in a child. It may occur during the course of or convalescence from the acute infec-

tious diseases; diseases of the gastroenteric tract; in degenerative or inflammatory conditions of the heart muscle; in uremia; and in diseases of the central nervous system.

Symptoms.—No special symptoms are present except a very slow pulse. There may be a disinclination to and perhaps an inability for violent play or exercise.

TACHYCARDIA.

This is an opposite condition from bradycardia, the heart's action being very rapid.

Symptoms.—Apparently without cause and without warning the heart begins to beat very rapidly, tumultuously and irregularly. The pulse is accelerated to 110, or not quite so high, and may reach 140 or 150. Palpitation may be a feature of the case, and oppression of breathing. A diagnosis from Graves' disease must be made in all cases.

Treatment.—Removal of the cause, if possible; control of the diet and limitation of foods which ferment; carefully regulated exercise and regular bathing.

If palpitation is a feature, morphine will be of most benefit; the bromides may control the attack; nitroglycerine is given in certain cases; aromatic spirits of ammonia. If there is pain, an ice bag can be applied to the precordial region.

These children may stand the strain of school rather badly, and its effect should be carefully noted by the teacher.

ACUTE MYOCARDITIS.

Definition.—This is an inflammation of the heart muscle.

Etiology.—It may occur independently of endocarditis or pericarditis, but secondary to infectious or septic diseases, notably diphtheria, the toxins being the active cause.

Pathology.—The muscle of the thicker ventricular walls is chiefly involved, and the process has been described as parenchymatous and interstitial. There is a granular degeneration of the muscle fibers which are soft and the muscle itself flabby. Pus may be found in the muscle wall in the interstitial form, this form occurring as a sequel to pyemic conditions.

Symptoms.—Occurring as myocarditis does, as a sequel to infectious diseases, diphtheria especially, the symptoms appear as convalescence seems established. The most noticeable condition is a weakening of the heart's action, which may be evidenced by the character of the pulse, pallor, apparent shock and inability to exercise in the least. The pulse is accelerated, regular as to time, but irregular as to force and volume. Because of the feebleness of the heart's action, there is no apparent apex beat, and the sounds are indistinct and muffled. Vomiting is usually present and in connection with a weak, slow or irregular pulse is not a good sign. Pain in the precordial region may be present.

Prognosis.—Sudden death is not uncommon in these cases. The child may be playing about, apparently normal, fall and expire in a remarkably short time. The pulse returning to normal is the best sign of improvement. A very slow pulse is unfavorable.

Treatment.—Prevention, if possible. The earlier diphtheria antitoxin is used the less chance there is for a myocarditis developing. Absolute rest in bed, with easily digested food. Pain is relieved by codeine or morphine, strychnia is a very important adjuvant, and tonics during convalescence, cod liver oil and iron especially.

CHAPTER XVIII.

DISEASES OF THE BLOOD.

THE BLOOD OF INFANCY AND CHILDHOOD.

A study of the blood is a most important diagnostic aid in many febrile and other conditions in infancy and childhood. An examination of the blood is proceeded with as follows: The lobe of the ear should be selected for the puncture. It is cleansed with a damp sterile or clean cloth and dried. With a triangular-pointed needle, lancet, or large sewing-needle, the skin at the lower edge of the lobe is *quickly* punctured. The first few drops of blood are wiped off, and the next can be used for diagnostic purposes. If to be examined at once, with a cover-slip touch the center of the drop of blood without touching the skin and drop the cover-face down on a *clean* glass slide. From the examination of this slip can be learned whether there are any plasmodium malaria or the blood parasites; relative number of white cells, number and character of the red blood cells, and whether there is an increase in the "blood plates."

Counting the blood corpuscles is done best by a Thomas Zeiss counter. To do this, the blood is drawn in a special pipette, diluted and mixed, placed in the chamber of the counting slide and the corpuscles counted. If the distribution of the cells seems uniform over the ruled disc, the counting is begun. An objective Leitz 5 or Zeiss D and a No. 1 or 2 eyepiece are best used. When the number of corpuscles in 360 squares has been counted the number must be divided by 360, and multiplied by 800,000, which gives the number of corpuscles in 1 cubic millimeter. These figures and the amount of dilution are marked on the pipette.

The pipette should be cleaned and dried as soon as the counting has been completed.

In counting the white cells the "white counter" is used, and a diluting solution which renders the red cells invisible.

Hemoglobin may be estimated by means of Dare's, Tallquist's, Oliver's or Von Fleischl's hemoglobinometer. The Tallquist

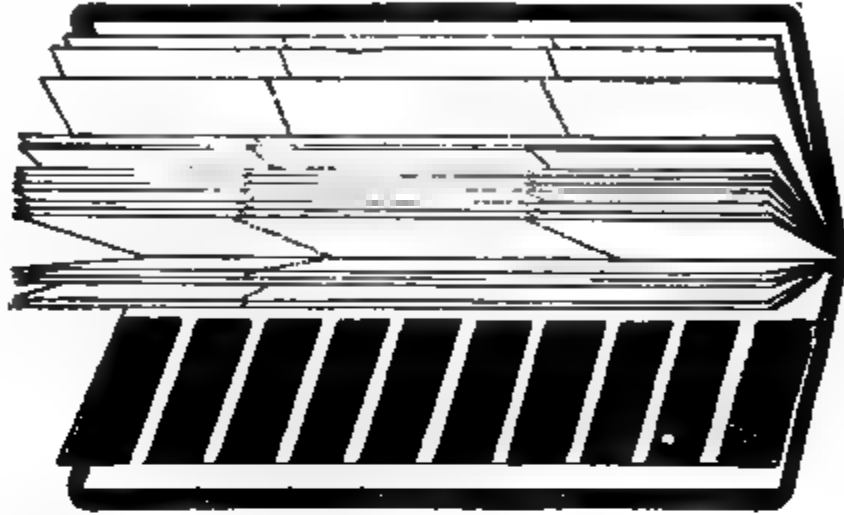


Fig. 81 — Tallquist hemoglobin scale.

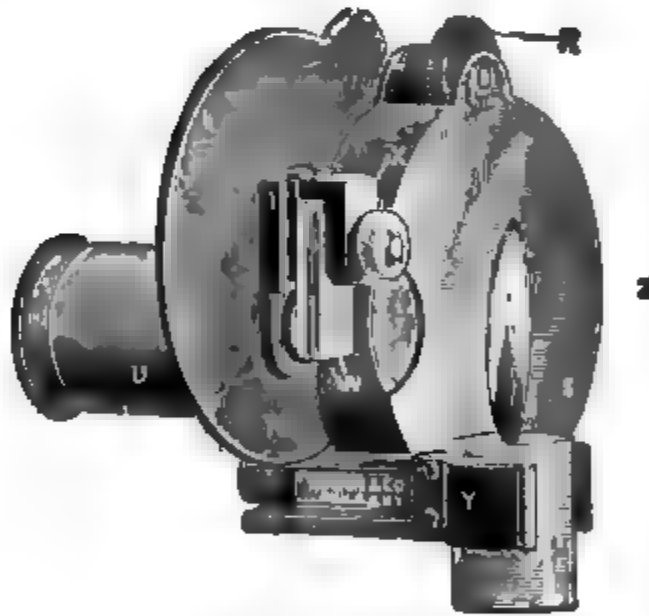


Fig. 82 — Dare's hemoglobinometer

scale is used by soaking into standard filter paper a drop of blood and comparing it with a water-color scale of 10 tints, and is accurate enough for bedside test, an error of not more than 10 per cent being made.

Oliver's instrument consists of a series of 12 tinted-glass discs arranged in two rows, the color scheme corresponding to hemoglobin percentages of from 10 to 120.

Von Fleischl's instrument, the cell holding the diluted blood,

has a moving color scale underneath, with reflected light shining through it. The scale is moved back and forth until the color of the glass is the same as the blood. The percentage of hemoglobin is given on the scale.

At birth the hemoglobin percentage is high, usually 100, but after a month or so decreases to 60 or 80.

The color index of a specimen of blood is obtained by dividing the per cent of hemoglobin by the per cent of red blood cells.

Red Blood Corpuscles.—The blood being spread thickly shows the red cells in rouleaux, hence thin spreads must be made if the cells are to be examined. They are round, biconcave discs, varying little in size in health, averaging about $7.5\ \mu$.

In disease the red cells may be very small, $2\ \mu$ to $4\ \mu$, *microcytes*, or they may be very large, $10\ \mu$ or even $20\ \mu$, *megalocytes*, when misshapen they are called *poikilocytes*.

During fetal life nucleated red cells are found, but they disappear as the number of red cells decrease and only recur as a result of disease. The nucleated red cells are divided into the *normoblasts*, an immature red cell, the nucleus staining very dark. It is found in severe anemias, chlorosis, etc.

The *megaloblast* is a very large cell (11 to $20\ \mu$) with large nucleus, and occurs in certain grave forms of anemia. Its protoplasm stains irregularly. The *microblasts* are much rarer than either of the other.

The number of red blood cells (erythrocytes) is greater during the first forty-eight hours after birth, Hayem placing the number at 5,900,000, gradually lessening in number to 4,500,000 at the end of the first week.

White Blood Corpuscles.—The following varieties of white corpuscles are recognized:

1. *Polymorphonuclear neutrophilic leucocytes or the polynuclear leucocytes.*—These cells comprise most of the white blood corpuscles, and are those found in pus. They are irregular in shape and none are exactly alike, and stain deeply with basic dyes. Stained with Wright's stain the nucleus takes on a deep blue color, the protoplasm pink. Their size is $13.5\ \mu$.

2. *Lymphocytes.*—These are referred to as lymphocytes and large mononuclear cells. The lymphocyte varies in size from

size of red cell to larger, and has a nucleus which stains deep blue. The larger cells are much larger than the lymphocytes and have an oval nucleus. The large cell is 13 μ , the small 10 μ .

3. *Eosinophiles*.—These cells are polymorphous. The granules are 1 μ in diameter. They take the Wright stain, the nucleus stains lilac, the granules a bright pink, and the protoplasm a pale blue.

4. *Mast Cells*.—These stain with Wright's stain. They are twice the diameter of the red cell. They are 15 μ in size.

The frequency of the various white cells is given as follows:

	<i>Infants</i> ¹	<i>Adults</i> ² <i>Per cent.</i>
Lymphocytes	40 to 60	20 to 30
Large mononuclears		4 to 5
Polynuclears	18 to 40	62 to 70
Eosinophiles	2 to 4	$\frac{1}{2}$ to 4
Mast cells		1/40 to $\frac{1}{2}$

Myelocyte.—This cell is found normally in the bone marrow, and is found in the blood stream only under abnormal conditions, as in diphtheria. It stains best with Ehrlich's stain. It has a large number of granules, and they take the acid dyes.

They are 15.75 μ in size.

Degenerated Leucocytes, which are chiefly degenerated lymphocytes and large mononuclear lymphocytes.

Number of Leucocytes.—In the blood in infancy the number of leucocytes is greater than in adults. At birth they may reach 20,000 to 25,000. In a week or so the number falls to 9,000 to 15,000, and later in childhood they are still fewer in number, 7,000 to 10,000. After the third year they will average 8,000.

General Consideration of Blood Changes.—The examination of the blood should be considered in the light of a clinical phenomenon. Stained smears show the relative number of white and red corpuscles, and to the trained eye this is often equivalent to a differential count. The stain also shows the plasmodia malaria, filaria and other blood parasites, as well as the character of the red cells.

¹ Carr: Practice of Pediatrics.

² Cabot.

There may be a decrease in the number of red blood cells, as in the anemias. There is a temporary increase in their number in cyanosis.

Physiologically there may be an increase in the number of the white blood cells. This occurs normally after digestion, exercise and cold baths. A transitory increase is termed *leucocytosis*. The term relative leucocytosis is used when there is an increase in any type of leucocyte, as *lymphocytosis*, occurring in congenital syphilis and scorbutus; *eosinophilia*, occurring in leukemia; *neutrophilic leucocytosis*.

Leucocytosis, as stated, is the rule in the blood of infants and occurs as a result of intestinal disorders, congenital heart disease, rachitis, chronic tuberculosis, toxemias, diphtheria, syphilis, pertussis, pus conditions, etc.

Leucopenia is used to describe a decrease in the total number of leucocytes. It occurs in malaria, measles, influenza, gastrointestinal troubles of inflammatory type, etc.

ANEMIA.

It must be borne in mind in the examination of the blood of infants, the normal tendency to a lymphocytosis and the lower hemoglobin percentage, when compared with adults.

In anemia there is a deficiency in the red blood corpuscles and a decrease in hemoglobin, the coloring matter of the red cells. With these changes there may be a decrease in the total volume of blood. The anemias are classified as primary and secondary.

Primary Anemia.—*Definition.*—By this form is generally understood the anemias, the cause of which is unknown, as *pernicious anemia*, there being a grave blood condition, enough to cause death, yet the underlying cause not known, and *chlorosis*.

Secondary Anemia.—*Definition.*—This can be described as a *symptomatic* (Cabot) anemia, the blood changes being due to certain conditions which are more or less well known, as *hemorrhage*, *malaria*, *syphilis*, *tuberculosis*, *gastrointestinal disease*, *scorbutus*, *rachitis*, etc.

In the *secondary* form of anemia there is a diminution in the coloring matter, the number of cells remaining near normal.

It presents in the form in which the red cell is deformed, *poikilocytosis*; they may change as regards their staining qualities; the formation of *nucleated red cells*, the *normoblasts*, *megaloblasts* and *microblasts*.

PERNICIOUS ANEMIA.

Synonyms.—*Progressive pernicious anemia; anemia infantum.*

Definition.—This is the form of anemia which is generally fatal, and presents a definite blood picture without apparent cause. It is comparatively rare in infants.

Etiology.—This is not known, save that the so-called simple secondary anemias have been known to develop into the pernicious form. The *ankylostoma duodenale* has been given as a cause in the South. It has been estimated¹ as occurring in about 2 per cent of all internal diseases. It occurs slightly more often in males and with great rarity under five years of age. Rotch did not find a single case in 2000 cases of children's disease in the Children's Hospital of Boston. Stengel believes the *bothriocephalus* may produce this form.

Pathology.—The anemia, pallor and the extravasations of blood into and the fatty degeneration of the internal organs is noticeable at once. Free iron is found in the internal organs, especially the liver. The chief pathologic changes are in the heart. The central nervous system and cord show the same hemorrhagic condition as the other organs in addition to anemia.

The *bone marrow* in this disease differs from the normal in that there is a large increase in the megaloblasts.

The red cells are markedly decreased, averaging from 1,500,000 to 1,000,000. The hemoglobin is usually decreased, but not in proportion to the reduction in red cells, but the opposite may as frequently be seen, viz., a relatively high hemoglobin, considering the diminution in red cells. The amount of blood is usually reduced and coagulation in fresh blood is much slower. The fresh blood looks pale in color. The number of leucocytes is also reduced. The blood does not show the usual rouleaux formation. The oval-shaped red cells may predominate.

Symptoms.—The onset of pernicious anemia is insidious. It

¹ Lazarus; Nothnagle: Diseases of Blood.

may at first be diagnosed as a simple anemia with gradually increasing debility and lack of energy, with decreased endurance. Pallor of the skin followed by a distinct lemon-yellow color, develops very soon. Anemia of the mucous membrane follows; there is dyspnea, anorexia, perhaps nausea and vomiting, loss of flesh and edema. Palpitation is frequent on the least exertion or excitement. Small hemorrhages may occur in the conjunctiva and the skin. Hemic murmurs are frequent. Frequently distinct remissions occur, when there is an apparent improvement in all the symptoms.

There is an increase in the number of the red cells, approaching normal, a decrease in the megaloblasts and increase in the normoblasts. There is an increase in the leucocytes, mostly the polymorphonuclear neutrophiles.

The digestive symptoms are improved and the palpitation lessened or absent entirely.

These remissions may be permanent, the case progressing to complete recovery, when apparently hopeless before, or go on to a fatal termination after a very short period of remission.

The course of the disease is variable, usually under a year.

Diagnosis.—The general appearance of the patient is always suggestive of the form of anemia present. In no other form is the pallor or anemia as intense, but without careful and repeated blood examination a diagnosis is not justified. The group of symptoms enumerated above, with the characteristic blood findings, makes a diagnosis certain. These important changes are a marked decrease in the red cells, to 1,500,000 or below, and an increase in their size; diminished number of white cells; slight relative decrease in hemoglobin; presence of megaloblasts in increased numbers.

Prognosis is graver, though apparently hopeless cases have recovered after a period of remission. If it is a bothriocephalus anemia, and the anemia improves, the prognosis is very good. The nearer the red cells decrease to 1,000,000 the graver the prognosis.

Treatment.—The removal of the bothriocephalus latus, if it or its eggs can be demonstrated, is the first indication. Felix mas is perhaps the most efficacious anthelmintic for this worm.

Special attention should be given the stomach and intestine by regulating the diet, controlling diarrhea, if present, and the administration of remedies to limit the fermentation, bismuth and salol are especially efficacious. Constipation, if present, can be controlled by enemata.

Arsenic is the remedy which gives the best results. It should be given in small initial doses, gradually increasing until the full physiologic effects have been noticed. The dose should then be decreased 20 per cent, and its administration continued for several weeks at that dose. Fowler's solution is the best form for administration.

The employment of direct transfusion of blood offers much, and should be used when possible.

The patient should be given every opportunity to rally as regards his surroundings, climate, rest, freedom from work and worry, and during a remission extra precautions taken in these details.

CHLOROSIS.

Definition.—A primary anemia which occurs in girls about the age of puberty. There is an anemia, with diminished, though not a marked increase in the number of red cells and a lowered hemoglobin percentage.

Etiology.---It can be said practically that chlorosis occurs only in girls, and it is most frequent at puberty, from the twelfth to the eighteenth year. Often a history of chlorosis in the mother, or members of her family, can be brought out, or a tuberculosis in the family. A chronic intestinal indigestion and putrefaction, causing an autointoxication, may be a cause. Bad hygienic surroundings in factories and in crowded dormitories with insufficient ventilation may be a predisposing cause. Constipation, improper food, lack of proper exercise and tight lacing and the changes incident to puberty are given as causes.

Pathology.—The chief changes occurring in the blood are as follows: The *hemoglobin* is reduced to a decided extent, reaching as low, in some isolated cases, as 20 per cent, the average being about 40 per cent; the number of red cells are reduced, but not to the same extent as indicated by the reduction of the hemoglobin. The average number of red cells is about 4,000,-

000. They are pale, not deformed, but apt to be smaller than normal. Poikilocytosis is present in severe cases.

The white cells may be normal in number.

The specific gravity of the blood is reduced.

Symptoms.—The first symptom noted may be a disinclination to exercise in a previously active girl, palpitation, short quick breathing or dyspnea, on going up the steps, dizziness, followed in a varying time by pallor of the skin and mucous membranes, the skin having frequently a greenish tinge.

The changes in menstruation are more or less constant; in the majority of cases it is absent entirely, if present it is very irregular as to time and quantity and color of the flow. This irregularity of menstruation may be the first symptom noted. Pain before or early in the stage of flow may develop. Leucorrhea is very often present. The appetite is poor and often capricious, craving for acids is often a feature. Headaches are common, and are often associated with ringing in the ears. The circulation is poor, hands and feet cold. Blowing systolic murmurs are often heard, at various parts of the precordia, and a venous hum, *the bruit de diable*, develops over the large vessels in the neck.

No great changes are found in the urine. There may be an increase with low specific gravity. The spleen may be enlarged, but not markedly so. Hysteria, or milder form of irritability, may be seen in the specially neurotic girl. The duration is variable, usually, however, running for several weeks.

Diagnosis.—The principal diagnostic features are the sex, age, anemia and blood findings, viz., marked diminution in hemoglobin, without corresponding diminution in the number of red cells, rapid improvement under proper treatment. In making a diagnosis tuberculosis will have to be excluded.

Prognosis.—Influenced greatly by the period of recognition and time of beginning and persistence in treatment.

Treatment.—All girls at puberty should receive careful attention. Rest at menstrual epochs, and carefully regulated diet and exercise is very important. The articles of diet specially indicated are the fats, vegetables and fruits. Those vegetables containing a large supply of iron are best, as the green vege-

tables, spinach, etc. A change from the city to the country is also of great benefit as a prophylactic.

At the first sign of anemia or the preliminary symptoms of chlorosis the girl should be taken from school, or a very carefully graded course outlined in connection with baths, diet, exercise and regulation of the bowels. The medicinal treatment is largely symptomatic, except the positive indication for the administration of iron.

The bowels must be regulated by mild laxatives, cascara sagrada, aloin, belladonna and strychnia, etc., and other symptoms treated as they arise.

Iron must be given in some form; metallic iron; ferrous and ferric salts; albuminates and peptonates; nucleoalbumin preparations.

Diastiron is very assimilable and easily taken care of by most children. It can be given in a half to one teaspoonful, initial dose, gradually increased to two teaspoonfuls.

Pil Bland, 5 grains, is an excellent method of administration of iron, beginning with one after each meal, gradually increasing during the second week to two after each meal, then decreasing to the original dose after a week. The following prescriptions are often found of service:

℞ Tincture ferri chloridi f.℥ss
 Acidi phosphorici diluti f.℥vi
 Spiritus limonis f.℥ii
 Syrupi simplicis q.s. ad f.℥vi
 M. Sig. Dessertspoonful in water after eating.

℞ Acidi phosphor. dil.
 Acidi nitro-mur. dil.
 Acidi sulphurici aromat.
 Tr. ferri chloridi āā f.℥ss
 M. Sig. Twenty drops in half glass of water.

Iron should not be continued indefinitely, nor should it be given when no improvement in general symptoms or hemoglobin has been obtained in a short time, or when it produces decidedly bad symptoms with the digestive organs. One remedy which can be used to advantage in chlorosis is arsenic. The following pill is of service:

℞ Ferri reducti gr. lxxv
Acidi arseniosi gr. iii
Ext. glycyrrhizæ q. s.

M. et ft. pil No. C

Sig. One to four pills daily. (V. Noorden)

LYMPHATIC LEUKEMIA.

Definition.—In this disease the characteristic symptom is a great increase in the number of leucocytes, with an increase in size of those organs specially associated with blood-making, spleen and glands.

Two forms are recognized, the *acute*, in which there is a rapid and fatal termination in a few weeks, and the *chronic*, which may continue for months.

The Acute Form. Etiology.—Two types are recognized, the *myeloid*, in which there is great hypertrophy of the spleen and bone-marrow changes, and but little lymphatic enlargement, or the *lymphoid*, in which there is generally a hyperplasia of the lymph nodes, and in which the blood shows particularly the lymphocytes.

Leukemia may occur at any age. Heredity is a causative factor. Among the other predisposing causes may be mentioned intestinal intoxication; poor surroundings and hygiene; malaria; syphilis; tuberculosis; influenza and rachitis.

Pathology. The Myeloid Form.—The essential changes are in the blood, bone marrow and spleen. The red cells are slightly diminished in number, averaging about 3,500,000. The hemoglobin is diminished probably to 50. The red cells show many nucleated forms. The typical changes in the blood are in the white blood corpuscles. The leucocytes are greatly increased in number, varying from 100,000 to 300,000, though there may be a far greater increase.

The myelocytes are greatly increased in number. They may comprise more than one-third of the number of cells, and from this feature alone the diagnosis can be made. Polymorphonuclear cells are slightly increased in number, both large and small, with nuclei staining differently. Lymphocytes are decreased quite decidedly, but not as much so as the myelocyte.

The glands show cell proliferation and enlargement.

Hemorrhages are of frequent occurrence, both on mucous surfaces and skin, and ulceration takes place in these areas. They may occur in the glands also.

The bone marrow is changed from the normal fat marrow to a dark, wine-colored, soft marrow.

Lymphatic deposit occurs in the spleen, liver, kidneys, esophagus, stomach and intestine, tonsils and thymus, all of which show enlargement or thickening.

Symptoms.—The course of acute leukemia is short, from a few days to several weeks, rarely lasting months. The onset is usually insidious, but it may be sudden, or at least few symptoms are present while the preliminary blood changes are occurring, which the patient will complain of.

Lassitude, weakness, dizziness, headache, may precede the actual symptoms. This is followed by pallor of the skin and mucous membranes, and shortly by enlargement of the lymph nodes, spleen and tonsils. The spleen, when enlarged, is palpable. Hemorrhages occur in the skin, mucous membrane and in the eye. The hemorrhages in the skin may be simply petechiæ or large bruise-like areas. These also occur in the mucous membrane of the mouth, gums and palate. Nasal hemorrhages may occur. Necroses may develop at the site of these hemorrhagic areas. Hematemesis and hemorrhage from the bowel may be seen, and these active hemorrhages may cause death.

Diagnosis.—The blood changes are typical of the disease. In no other condition is a lymphocytosis so marked.

Prognosis.—This is unusually grave. Hemorrhages and septic infection at the site of necrosis may hasten the end.

Treatment is of little avail and is largely symptomatic. Good food, stimulation when indicated, fresh air, the best surroundings and administration of iron.

The Chronic Form.—In this class are included those rare forms in which the duration is longer than a few weeks. They present the same general symptoms and blood findings.

Etiology.—Nothing definite is known of the etiology of this or the myelogenous form of leukemia; of late some interesting suggestions have been made that it is probably the result of an infection.

Pathology.—The chief change is in the lymph nodes. The glands of the neck and thorax are principally enlarged. They may be soft and tender. The spleen is enlarged, in some cases to a considerable size. The bone marrow is reddish in color and of jelly-like consistency. The liver is enlarged, as are the tonsils. Tumors form in the skin, generally quite small and shot-like, but they may enlarge to considerable size.

Symptoms.—The onset is usually gradual. It is often chronic in form. The anemia may precede the enlargement of the lymph nodes or *vice versa*. The glands of the neck usually show the greatest proliferation and enlargement, with smaller ones in the axilla and groin. It may be possible to palpate the mesenteric glands. The spleen regularly shows an enlargement, sometimes to enormous proportions.

The blood shows a *lymphocytosis*. Of the increase in leucocytes, 90 per cent of them will be lymphocytes. The average ratio of white to red cells is about 1:50. The lymphocytes are usually of the small variety, under 10 μ in diameter, in the chronic form, and larger in the acute form. The red cells are reduced to 3,500,000, or lower, and the white cells, 300,000. Eosinophiles or myelocytes are very scanty or absent. Hemoglobin is decreased.

Hemorrhages are infrequent.

Dyspnea is a frequent and early symptom, which is due partly to blood changes, and chiefly to obstruction from enlarged lymph nodes.

Diagnosis.—The presence of the *lymphocytosis* is the chief diagnostic sign. In the presence of anemia, enlargement of lymph nodes and spleen, the blood should always be examined.

Prognosis.—The progress of this disease is toward a fatal termination, though it may last for months.

Treatment.—Practically nothing can be done in this form, as in the myeloid form, except to care for the case systematically.

If symptoms from the glandular enlargement in the neck are present, surgery is indicated for relief, if the general condition is fairly good. Arsenic is indicated and should be given as early as possible.

PSEUDOLEUKEMIA.

Synonyms.—*Hodgkin's disease; lymphoma.*

Definition.—This is a primary disease of the lymph structures. There is an enlargement of the lymph glands and spleen, much as in lymphatic leukemia, but without the blood changes in the latter.

Pathology.—Early in the disease the blood may be normal, but the hemoglobin decreases as it progresses, and there is a decided anemia. At first there may be no change in the white cells, but later there is a marked increase in the white cells, a ratio being sometimes seen (in the presence of adenitis) of 1:80 when compared to the red cells. The increase is chiefly in the lymphocytes.

The red cells are progressively diminished in number.

Symptoms.—The chief symptoms are those pointing to the lymph glands. These may be hard or soft. The spleen is regularly found enlarged. The glands of the neck show the greatest enlargement. With the progress of the anemia the constitutional symptoms develop, weakness, dizziness, fainting, palpitation, etc. Skin tumors develop as in lymphatic leukemia. Its course is slow and death may occur from pressure on the vessels of the neck and on the trachea and bronchi.

Diagnosis.—The enlargement of the lymph nodes, with blood changes, showing lymphocytosis, a relative increase of 1:200 ratio of white to red. The diagnosis must be made from a glandular *tuberculosis*, in which there will not be any of the typical blood changes, and from *lymphosarcoma*, in which the lymph glands show malignant change and the blood changes are not those of pseudoleukemia.

Prognosis.—Death is not as prompt as in leukemia, but just as certain in time. There is no cure.

Treatment.—Apparent improvement has been reported from the use of arsenic and the iodides. Surgery is not to be recommended. In the large growths about the neck, some good may be accomplished by the use of the X-ray.

PSEUDOLEUKEMIA OF INFANTS.

Synonyms.—*Anemia pseudoleukemic infantum (v. Jaksch); pseudopernicious anemia (Ehrlich).*

Definition.—This is a grave form of anemia, first described by v. Jaksch in 1889. There is a severe anemia, leucocytosis and enlargement of the lymph nodes, spleen and tonsils.

Etiology.—It may occur independently or develop from some of the grave anemias. It occurs between the seventh and ninth month and the fourth year. Congenital syphilis is a predisposing cause.

Pathology.—The chief change is an enlargement to considerable size of the spleen, which can be seen through the abdominal wall. It is hard to the feel. The *liver* is slightly but not markedly enlarged. The *lymph nodes* are quite regularly enlarged, but not to the size seen in typical pseudoleukemia.

The *blood* shows a marked diminution in the hemoglobin, often considerably below 50. There is a regular decrease in the red blood cells, to 2,000,000 or below. Nucleated red cells are found, megaloblasts and normoblasts.

The white cells are increased, myelocytes are found. They stain irregularly.

Symptoms.—There are no typical symptoms. Those common to the other types of anemia are present. There is generally a loss of appetite; enlargement of glands and spleen; emaciation, with a tendency to develop into a chronic condition. Syphilis may be suspected instead of the anemia.

Treatment.—The administration of iron and arsenic and the careful regulation of the feeding are the most important indications to be met.

In older children a rich proteid diet is best; meat, eggs and milk; in the younger a fat increase should be made and continued as long as well borne.

PURPURA.

Definition.—This is a condition characterized by hemorrhages occurring under the skin and from the mucous membranes.

Etiology.—It is divided into two varieties, *purpura simplex*, the bleeding being limited to the skin, and *purpura hemorrhagica*, where there are also hemorrhages into the internal organs and from the mucous membranes.

It may be due to septic conditions and the infectious diseases, as septic endocarditis and the exanthemata; as a result of exhausting diseases, as bronchopneumonia, pertussis, typhoid fever, ileocolitis, tuberculosis; from the administration of certain drugs, as phosphorus, quinin, salicylic acid, arsenic, belladonna, etc.; or it may occur without any apparent cause. It occurs chiefly under 10 years of age.

Pathology.—No definite pathology is known, except there is an endarteritis, without characteristic changes in the blood. Hemorrhages occur in the internal organs, chiefly the suprarenal capsules.

Symptoms.—In the ordinary form, *purpura simplex*, after a day or so of indisposition, headache, anorexia, perhaps some indigestion, a number of petechial spots appear upon the skin, chiefly at first upon the anterior surface of the lower extremities and buttocks, and finally generally upon the whole body. Later there may be larger areas of extravasation, large, bruise-like spots. As the hemorrhage is absorbed it leaves a bluish-black discoloration. Not infrequently some fever is seen, to 100° F., or slightly more. Joint pains may be present in older children.

Purpura hemorrhagica (also called morbus maculosus, Werlhoff's disease).

In this form, besides the skin hemorrhages, petechial and ecchymotic, there are hemorrhages into and from the mucous membranes, hematemesis and bloody stools, nosebleed (the most common) and exophthalmos, caused by orbital hemorrhage. The skin hemorrhages are more numerous. Joint pains, due to hemorrhages into them, are common. There are some constitutional symptoms, temperature from 101° F. to 103° F., with prostration, dry tongue and mouth, sleeplessness, the patient falling into the typhoid state, with coma or delirium.

Blood which has been swallowed should be differentiated from true melena.

Where the case progresses rapidly and is quickly fatal it is referred to as *purpura fulminans*.

Henoch's Purpura.—In this form there are three groups of symptoms described; *skin* presenting petechial and ecchymotic

hemorrhages, besides urticaria, and perhaps edema; swelling and pain in one or more joints; and the *visceral* symptoms, consisting of colic, diarrhea and vomiting, and occasionally the passage of blood both ways. In addition there may be *hematuria*, as well as an albuminuria.

The tendency in this form is to be apparently entirely relieved, with recurrences over a period lasting perhaps several years.

Purpura rheumatica (Schönlein) is the occurrence of hemorrhages in the skin in an attack of rheumatism. There are enlarged and painful joints, with frequent endocardial involvement, temperature, albuminuria, erythema nodosum, etc.

Prognosis depends upon the form of purpura. In the *simple form* it is good, with tendency to relapses; in the *hemorrhagic form*, where the bleeding is not profuse, the child may recover. In the *fulminans* type it is rapidly fatal; in *Henoch's purpura* recoveries are rare, where it has recurred frequently.

Treatment.—In all varieties the child should be put to bed and kept there until all symptoms are relieved. An antiscorbutic diet, fruit juices, fresh milk and vegetables should be given. Ergot has been tried without success. If the hemorrhage is profuse, subcutaneous injection of gelatine solution should be tried. Direct transfusion of blood may offer some help. Adrenalin, five minims of a 1:1000 solution, hypodermatically can also be used. Iron and tonics are indicated in convalescence. Normal horse serum may be used.

HEMOPHILIA.

Definition.—This is a hereditary disease in which there is a tendency to severe bleeding from any surface, from a very slight abrasion, or into the tissues. One so affected is called a “bleeder.”

Etiology.—The hereditary tendency in typical cases is quite marked, and may be traced through several generations, with one or more of each family similarly affected. Males are oftener affected than females, but the transmission of the tendency is more often through the female side of the family, though she may herself escape it. Even though herself healthy, and married to a healthy man, their male offspring are liable to develop it.

Race may play a part. It is frequent in the Jews. It may develop in early infancy or be delayed until after the eruption of the deciduous teeth.

Pathology.—This is unknown. There may be an endarteritis or a thinning of the vessel walls. The chief change in the blood is the lack of coagulability.

Symptoms.—The condition may go unrecognized until a bleeding occurs from an apparently trivial cut or abrasion, which assumes an alarming proportion quickly. If an abrasion it may be an oozing, which pressure or other hemostatic measures ordinarily used does not stop. The bleeding may occur from the mucous membranes, especially the nose, following trauma, into the skin or joints. A mere scratch, the pulling of a tooth, the cutting of a tooth in an infant, may cause severe and dangerous bleeding.

Diagnosis.—This can be made from the amount of hemorrhage which follows a trivial abrasion, cut or trauma, and the distinct hereditary history.

Prognosis.—These children, if the case is a decided one, rarely live to puberty; should they pass this period the chance of death being caused from hemophilia grows less and less. There is no great tendency to increased bleeding in females at menstruation or postpartum.

Treatment.—Prophylaxis is the main consideration. Prevention of cuts and trauma, but if trauma should occur the hemorrhage should be stopped as quickly as possible. Styptics are not of very great benefit but should be tried, perchloride of iron, tannic acid or adrenalin may be used. Rest in bed should be insisted upon. Operations should not be performed, especially removal of the tonsils and adenoids. Adrenalin (1:1000, 5 or 10 min.) ergot, liquor ferri chloridi (20 min.) can be used internally. Fuller recommends the use of thyroid extract.

Normal horse serum should be used before the case is hopeless.

CHAPTER XIX.

DISEASES OF THE LYMPHATIC GLANDS.

The lymph nodes are very prone to develop hyperplastic processes during infancy. Any group of glands may enlarge, or there may be a general enlargement of all of them.

THE THYMUS GLAND.

But little definite is known of the function of this ductless gland. It is quite regularly enlarged in the infant, and to it have been ascribed sudden deaths occurring without apparent cause in cases in which it was found to be enlarged.

It is found to extend from slightly above the sternal notch to the third or fourth costal cartilage, and may be 2 inches or more in width, and it may weigh from $\frac{1}{2}$ to 2 ounces.

The thymus is best outlined by percussion, showing as a triangular area of dulness, irregular in outline, its base at the sternoclavicular margin and the apex at the second rib. The sides of the triangle extend slightly beyond the margin of the sternum, a little more so on the left than the right. The thymus and precordial area of dulness may coalesce.

In children with an enlarged thymus, a condition of *status lymphaticus* exists. The subjects are pale, anemic and pasty in appearance, and in older children, especially girls, the symptoms are those of a chlorosis. There is usually a general enlargement of the superficial lymph nodes. They have but little resistance to infectious diseases, and are frequently affected with tonsillitis and bronchitis. Sudden death in these children is not rare, especially as a result of a general anesthetic, more especially chloroform. The death may occur after the first few inhalations, during the operation or after the removal of the cone. This should always be borne in mind before an anes-

thetic is given, when a diagnosis of this condition of status lymphaticus is made.

In cases of sudden death due to enlarged thymus, there is nothing else found at autopsy which can be looked upon as a cause. The only *symptom* which may be present is a sudden lividity, or cyanosis, followed by death. Direct pressure of the gland upon the trachea or the recurrent laryngeal or vagus nerve may be the cause of the death.

No *treatment* is of avail.

ACUTE ADENITIS.

Definition.—An acute inflammation and enlargement of the lymph nodes, local or general.

Etiology.—This condition is secondary to an inflammation of adjacent structures, skin or mucous membrane. The extent of the inflammation and number of glands involved depends on the extent of area of skin or membrane involved in the inflammation. The bronchial lymph nodes may be primarily involved from tubercular invasion, by direct absorption of the bacilli from the bronchial mucous membrane or the intestine.

Mesenteric enlargement occurs from absorption of tubercle bacilli and from acute inflammatory conditions of the intestinal tract.

Inflammations of the mucous membrane of the nose and throat, mouth, the pharynx and larynx cause an inflammation of the deep cervical glands, and an inflammation of the scalp, face and ear, cause an enlargement of the superficial glands of the neck. Vaccination upon the leg may cause a severe inflammation of the inguinal glands.

Pathology.—There is an acute congestion of the gland with hyperplasia of the lymphoid structure. If there is direct invasion of the pus-producing organisms, a softening and breaking down of the gland usually occurs.

Symptoms.—When secondary to other conditions, there is a rise in temperature, with swelling of the glands. If it is severe, redness of the skin over it develops, and it becomes quite tender and painful. An adjacent cellulitis may develop. In the acute cases there is temperature, irritability and restlessness.

Without suppuration the gland may remain firm and hard as long as the inflammation of the adjacent structures continues, and upon its relief the gland subsides.

A relapse of the cause will again cause enlargement of the glands.

Prognosis.—Except in tubercular glandular enlargement recovery follows, but not always without suppuration and destruction of the gland. In marasmic and cachectic children the condition is apt to develop into the chronic form.

Treatment.—The cause must be sought and removed, disease of the scalp and the mucous membrane treated.

Locally much good can be accomplished in the acute cases, without apparent pus formation, by the application of 50 per cent grain alcohol poultices on absorbent gauze, protected by rubber tissue, or the application of pure ichthyol. Mud poultices do no good, save to hold the part fixed, thus saving pain.

When much redness of the skin takes place and an area of softening, indicating pus formation, a free incision should be made and the gland drained.

Where they remain enlarged after subsidence of the contiguous inflammation, iodine in some form should be administered, the iodide of iron or hydriodic acid being beneficial.

CHRONIC ADENITIS.

This condition, in which there is a chronic inflammation and hyperplasia of the lymph nodes, usually follows an acute attack of inflammation. It may occur coincidently with a long-standing and chronic inflammation of the skin, as an eczema of the scalp, or of the mucous membranes of the nasopharynx and pharynx.

Symptoms.—The chief symptoms are the presence of enlarged glands, superficially situated about the body, as at the back of the neck, in the axilla and in the groin. These glands or groups of glands are hard, not tender, and show no tendency to break down or suppurate. The tendency is for them to remain stationary for some time, perhaps months, and then to gradually become smaller. The process is simply one of a hyperplasia of the connective tissue without inflammation. There is no fever

or inconvenience suffered by the child. It occurs most often under 10 years of age. In enlargement of the bronchial glands of sufficient size to cause pressure a cough is present.

Diagnosis.—If the glands assume some size the condition becomes suspicious of a general blood trouble, as Hodgkin's disease, or perhaps tuberculosis may be suspected.

Treatment.—Remove or alleviate the cause. If a skin lesion treat it properly; if there are chronically enlarged tonsils or adenoids they should be removed; the nose should also receive attention. Potassium iodide is of great service in the form of syrup of the iodide of iron or hydriodic acid. Cod liver oil, not the extracts of the oil, given in the cool months, is of great benefit. Good and nourishing food must be given, change of surroundings, perhaps of climate, may be indicated.

If the underlying bacterial cause can be ascertained the vaccines might be used with benefit.

ADDISON'S DISEASE.

This is quite a rare disease in children. Comby has selected 21 cases in literature; practically never seen under 10 years of age.

It is characterized by the same train of *symptoms* as seen in adults, viz., bronzing of the skin, which is due to a deposit of pigment in the malpighian layer, progressive weakness of general muscular system and pulse, and gastrointestinal symptoms, as vomiting and diarrhea. The bronzing is chiefly of the exposed parts of the body, though the rest of the body may be as deeply pigmented.

Pathology.—The chief change is a tuberculosis of the adrenal glands, with later tuberculosis in other organs, lungs, spleen, liver and glands.

Diagnosis.—Pigmentation of skin from arsenic and exposure must be borne in mind; neither are attended with the general symptoms referred to.

Prognosis.—This is always grave.

Treatment.—Tonic and supportive treatment is indicated. From the location of the chief lesion, the suprarenals, adrenalin may be tried, given in 2 or 3 drops of 1:1000 solution. Symptomatic treatment must be carried out.

CRETINISM (MYXEDEMA).

Definition.—This is a condition which evidences itself by a remarkable backwardness of the child in its growth, of body and mind, an abundance of deposit of fat or mucin out of proportion to its bodily growth; in other words a persistence of infantilism.

Etiology.—Nothing very definite is known of the cause. It has long been known to be prevalent in certain mountainous and limestone districts of Switzerland. This is looked on as the endemic form. Sporadic cases develop in any country, and a number have been reported in the United States.

The thyroid gland is at fault, an insufficient secretion being the cause. It may follow the exanthemata, though just what the connection between them is we do not know.

Pathology.—The thyroid gland is usually atrophied, or there may rarely be an enlargement, a goitre. Ossification is delayed.

Symptoms.—There is no regularity in regard to the onset. It is usually insidious, coming on as a rule after the second year, but may appear soon after birth. These cases have the appearance of a dwarf, the extremities are short, the body apparently too large. The face is expressionless and idiotic when the tongue protrudes from the mouth. The mouth is constantly open, and there is constantly a flow of saliva. The eyes are expressionless and the eyelids baggy. The teeth are cut late, are irregular in shape and decay quickly. There is an anterior curvature of the spine. The temperature is usually below normal, the skin baggy, harsh, cold and quite anemic and pale. The face is expressionless and the child apparently has no intellection whatever. The broadening of the base of the nose is characteristic. The fontanelles, especially the anterior, are apt to be open. There is a "pot belly," which is quite marked. They usually show no sign of talking, and sounds made are harsh and unnatural. They may be able to stand, and if urged, to take a few steps, but usually show no inclination to walk. Other cretins may be in the family, usually, however, other children are normal.

Diagnosis.—A mental picture of this condition should make diagnosis easy. From *Mongolian idiocy* the diagnosis may not

be so easily made. In the latter there is the Mongolian facies, they are more intelligent and not so deformed, the skin is not thickened, and the bridge of the nose not so wide. In this form the characteristic curving inward of the tip of the little finger is generally seen. Other conditions may be confounded, as *infantilism*, in which the infantile expression and size are maintained, with an atrophy of the genitalia. The skin is soft but dry, and appendages unhealthy; the mind is infantile also.

Infantilism of the Lorain type is described as a condition in which there is an imperfect development of the arterial system, causing insufficient nourishment. There is a premature ossification and stunted growth. A skiagraph of the hand shows ossification complete, while in myxedema there is a deficiency in the appearance of the nuclei of the carpal bones, and a failure of phalanges and metacarpals to unite. Thyroid treatment in this class of cases is unavailing.

Prognosis.—These cases, if unrecognized and untreated, may live considerably beyond puberty, but maintain the idiotic look and mind, and dwarfed body. If the cases are recognized and treatment begun early, the results are quite brilliant. Good results have been reported when treatment has begun after puberty.

Treatment.—As stated, the treatment of cretinism is brilliant in its results. Thyroid extract given internally quickly restores the child to normal. Dessicated thyroid extract can be given in tablet form, $\frac{1}{2}$ to 3 grains at a dose at first, increased to 5 grains at a dose, three times a day. To infants, $\frac{1}{4}$ grain or $\frac{1}{2}$ gr. should be given at first, gradually increasing to 1 or 2 grains. The thyroid should be given over a long period of time, at least four or five months, the dose then being given less often, with a few days' rest between. At first there may be a slight depressing influence from its use.

The first improvement occurs in a week or so, and is in the facial expression. The tongue no longer appears too large for the mouth, the dribbling of saliva ceases, the skin loses its myxedematous feel and appearance, the hair looks more natural, delayed teething takes place, the mental condition seems to quickly assume its proper proportions.

After the discontinuance of the regular dose of thyroid for several weeks, it is again given once or twice a week for several months, and for a long time the child should be kept under observation and the thyroid given if indications of mental dullness or sluggishness again appear. It may be necessary to continue the treatment by thyroid for life.

CHAPTER XX.

DISEASES OF THE GENITOURINARY SYSTEM.

THE URINE.

The urine of a healthy infant should be nearly colorless, should not stain the napkin, and of a low specific gravity, from 1004 to 1010. In the new-born the amount passed is much less than in older children, during the first 24 hours, probably not averaging more than an ounce. During this time there is apt to be a relatively large amount of the salts of urea, which appears as a very fine sand, and the urine is much thicker than normal. The uric acid may collect as infarcts in the kidney and cause a suppression of urine until dislodged and washed out. The failure to pass urine during the first 24 hours is an indication for the administration of water, both by the mouth and the bowel, to thoroughly flush the kidneys.

Uric acid remains relatively large in amount in proportion to the other urinary constituents during childhood.

It is often difficult to obtain a sample of urine from an infant for examination, and next to impossible to obtain a 24-hour specimen. In male infants, by attaching a rubber condom to the genital organs, including scrotum and penis in the neck of the rubber, and fastening by tapes around the waist, enough urine for a chemical and microscopic examination can easily be obtained. In girl babies this is often much more difficult. The appliance suggested by Chapin is a most useful one, and can be applied to the vulva and retained by tapes tied to the thighs or waist and worn without discomfort until the sample needed is obtained. The end of the urinal is put in a bottle, or a rubber tube attached, and its free end placed in a bottle.

Placing the child upon a rubber sheet without napkin or protective dressing, or placing a sterile sponge or piece of gauze

over the vulva or the penis, which as soon as wet is squeezed into a test tube, later filtered, may be successful if persisted in long enough.

The difficulty attending the obtaining of a sample of urine has unquestionably been the cause of neglect in the examination of the urine of infants in the past, but even if catheterization must be resorted to in order to obtain a specimen for examination, it should be done. Many obscure cases can be cleared up if the urine is examined, and too great emphasis cannot be laid upon it.

During the third month it is estimated 200 cc. of urine are passed in 24 hours with a specific gravity from 1004 to 1010, and from 1 to 2 grams of urea; during the sixth month, 250 cc. of urine, in 24 hours; specific gravity, 1006 to 1012; during the twelfth month, 400 cc. in 24 hours, with 11 grams of urea; from two to five years, 500 to 800 cc. in 24 hours; five to eight years, 600 to 1200 cc. in 24 hours; eight to fifteen years, 1000 to 1500 cc. in 24 hours. The urine gradually increases in amount to 1000 cc. in the tenth year, with a specific gravity of 1015, and 20 grams of urea.

ALBUMINURIA.

Normal urine contains nucleoalbumin, but not serumalbumin, and when serumalbumin is present it should be considered abnormal, and the indication of pathologic conditions. Serumalbumin is sometimes, but not with any regularity, found in the urine of infants during the first week after birth, but its persistence is indicative of abnormalities, such as nephritis, the acute and chronic parenchymatous forms, pus in any organ or cavity, etc. Albumin is quite regularly present during the acute diseases of childhood.

Croftan¹ describes an intermittent albuminuria and a cyclic albuminuria. He gives as causes of the first, nervous influences, exposure to cold, diet and overexertion, and describes a dyspeptic albuminuria, which is present in intestinal disorders and dilatation of the stomach. This form of albuminuria if continued for a long period leads to true nephritis.

¹ Croftan: Clinical Urology.

The urine of the infant is but faintly acid, often alkaline in reaction.

CYCLIC, or FUNCTIONAL ALBUMINURIA.

This condition is not infrequent in older children, especially about the age of puberty. As the name implies, albumin may be found in the urine during certain hours in the day, and at other times it is absent.

Etiology.—It is seen most often in boys. It has been thought to be due to severe and fatiguing exercise; cold and prolonged bathing; exposure to cold; continued indigestion; lithemia; but Croftan believes only two factors are to be considered in its etiology, viz., changes in the position of the body and muscular fatigue. The theory of the postural cause is that the albuminuria “is due to a certain reactive insufficiency of the circulatory apparatus,” that it is a “manifestation of a vasomotor fatigue.”

Pathology.—This form of trouble has no pathology, as there are no pathological changes. When an albuminuria is due to a change in the kidneys, the condition is no longer a functional trouble.

Symptoms.—Usually the albuminuria is discovered accidentally, as the child may not present any symptoms. The chief and only symptom perhaps may be an indigestion, and if persistent long, an anemia.

The urine does not show albumin continuously as indicated by the name given the trouble. No albumin may be present on arising, but by noon it is shown to some extent, and persists until night, when the amount gradually decreases, a prolonged stay and rest in bed may clear the urine entirely. An increase in the urinary salts may be seen, uric acid, urates and oxalates.

Diagnosis.—In every case of albuminuria the symptoms and urinary findings should be carefully weighed before a diagnosis is made. Frequent and careful chemical and microscopic examination of the urine should be made to exclude a nephritis. The presence of casts in a centrifugalized specimen of urine is sufficient to exclude functional albuminuria.

Prognosis.—Where the diagnosis can be made positively the prognosis is favorable.

A persistent albuminuria should be regarded with suspicion, as indicative of organic changes in the kidney.

Treatment.—Rest in bed while the quantity of albumin is large, careful diet, limiting the amount of nitrogenous foods; regular and graduated exercises, never to the point of fatigue, and not violent at any time. Occasional blood pressure tests should be made.

Occasional doses of calomel are of great benefit, with a mild saline following; and as suggested by Croftan “on the basis of the vasomotor fatigue theory, cardiac tonics are indicated, and good results have been obtained by this therapy.”

Change in climate may be necessary, to a warmer, more equable one.

PYELITIS.


Definition.—An inflammation of the lining membrane of the pelvis of the kidney. When the inflammation extends to the tubules of the kidney it is a *pyelonephritis*; when an accumulation of pus in the kidney takes place, a *pyonephrosis*.

Primary and *secondary* pyelitis have been described, but it is difficult to draw the line between the two.

Etiology.—The presence of a calculus in the pelvis of the kidney may act as an exciting cause. It occurs more frequently in female than in male infants, and is probably due to an extension of bacilli from the vulva and vagina to the pelvis of the kidney without a coincident urethritis or cystitis. The chief infecting organism is the colon bacillus, which may gain entrance direct from the intestinal tract. A diarrhea may precede the acute symptoms of the pyelitis. It occurs at any age, but in my experience most often in female infants between 6 and 18 months of age.

It may complicate the exanthemata, pneumonia or diphtheria or a general pyemic state.

Pathology.—The pathological changes are those of acute inflammation of a mucous membrane, congestion, swelling with possibly punctate hemorrhage. Pus is formed and is washed out with the urine. If the accumulation of pus is greater than is thrown off in this way, it distends the pelvis and calices and forms a pyelonephrosis.



Symptoms.—The onset is usually sudden and the symptoms obscure. The chief symptom is a persistent and irregular temperature, usually to 105° F., ushered in often with a chill or evidences of chilliness, manifested by blueness of the skin, cold hands and feet and feeble circulation. The temperature may show a decided remission or remain persistently high with but slight remissions, often with sweats.

There may be a preceding gastrointestinal disturbance or vomiting without any bowel disturbance.

No symptoms are present as a rule referable to the kidneys, no tenderness or pain in the loin or abdomen, though occasional cases are seen evidencing considerable pain in the back. Unless the condition is recognized by a careful examination of the urine the case may continue indefinitely, showing a continuous temperature, anorexia, emaciation, restlessness and profound anemia.

The *urine* is acid, contains albumin and on microscopic examination, a large number of pus cells is found. The urine is diminished in amount, is apt to be cloudy from the pus and kidney epithelia present. The epithelia are from the kidney pelvis and the ureter. If the condition has existed long, hyaline casts may be found, chiefly of large size. Many actively motile bacteria are present.

In the so-called secondary form of pyelitis in which a calculus is present, there is pain and tenderness, renal colic and blood in the urine. Bacteriological examination should be made in long-standing cases, looking especially for the tubercle bacillus.

In one of my cases the microscopist reported the presence of foreign bodies resembling the ova of an intestinal parasite, and it was puzzling to several who saw it, until I recalled the fact that lycopodium powder was used on the buttocks, and the suspected ovum proved to be the seed pod of the lycopodium.

Diagnosis.—This is not always easy, but will be made much more readily and often if systematic examinations of the urine are made. Every case of sudden temperature, in which diseases of the gastrointestinal tract and lungs can be ruled out, a pyelitis should be suspected, and a careful urinalysis made. The urinalysis is not complete without a microscopic examina-

tion. Pus, kidney cells, albumin, a highly acid urine and bacteria make the diagnosis certain. A vulvovaginitis must be excluded, but in this, as a rule, there is no fever.

Prognosis.—In uncomplicated pyelitis the prognosis is good. It is influenced by the time which elapses between its onset and the making of the diagnosis. Its course under treatment is usually about two weeks, and recovery is the rule.

Treatment.—Hexamethylenamine gives almost universally good results. It is administered in 3 grain doses to a child of one year, every three hours, with as much water during the 24 hours as possible.

If there is a complicating enterocolitis a preliminary dose of calomel and castor oil should be given, followed by a colon injection of normal salt solution, and a subsequent daily evacuation obtained. To neutralize the urinary acidity, Holt recommends potassium citrate, 2 or 3 grains, well diluted, every three hours. Acetate of potassium may also be used.

Unless there is a decided abnormal condition of the bowels, no change is made in the diet; milk, however, being preferred to any other article.

In cases which do not promptly respond to urinary antiseptics the use of the vaccines offer the best possible results. A careful bacteriologic examination of the urine is made and the bacteria identified. If of the pure colon strain, the stock colon bacillus vaccine can be used or if preferred, and a competent laboratory expert is available, an autogenous vaccine can be made and administered.

RENAL CALCULUS.

Synonym.—*Stone in the kidney.*

Etiology.—Stone in the kidney in children is infrequent. They have their origin in uric acid, though they may contain oxalate of lime also. Large calculi are comparatively rare. Bacteria and cellular detritus in an inflammatory condition of the pelvis of the kidney may form the nidus for a stone.

Symptoms.—Small calculi, more like sand, may form in the pelvis of the kidney and be washed free into the ureter and bladder, and passed from the bladder with the urine. These

frequently cause pain in their passage through the ureter, evidenced by restlessness and crying, a diagnosis of the condition not being made until the sand or calculus is passed from the bladder and found on the napkin or in the vessel. In the male the passage of the sand through the urethra is attended with great pain, and if the child is large enough, referred to the end of the penis. I have seen one stone which had evidently lodged for some time in the glans portion of the urethra and gradually increased in size there, as it took exactly the shape of that portion of the urethra. An examination was made to ascertain the cause of the painful urination and this stone found, very slightly distending the meatus. It was fished out with a fine hemostatic forceps and complete relief afforded.

If the stone is retained in the pelvis of the kidney a pyelitis and pyonephrosis results. Absorption takes place, chills, sweats, wasting, prostration and great pain, caused by the effort to pass it on through the ureter, too small to receive it.

If renal calculus is suspected an X-ray photograph should be taken.

Treatment.—Renal colic is very painful and usually requires anodynes for its relief. Opium in some form is necessary, paregoric or the deodorized tincture, in the minimum dose, repeated if need be. Relaxation from a general hot bath is of service. Hexamethylenamine is of great service in cases with infection from pyelitis. In the presence of very great pain, sepsis, chills, etc., the condition becomes a surgical one, and early operation for drainage should be performed.

Liberal water drinking in this condition is of the greatest benefit.

PERINEPHRITIS.

Definition.—This is an inflammation of the loose connective tissue surrounding the kidney, with or without the formation of pus.

Etiology.—It may be *primary*, due to trauma, exposure and cold, or *secondary*, following the acute infectious diseases, pyelitis or pyonephrosis, vertebral diseases, or renal calculus.

Pathology.—The loose connective tissue surrounding the

kidneys undergoes inflammatory reaction with frequent localizing of the process and the formation of an abscess.

Symptoms.—The onset is sudden, with a decided chill and pain located in the lumbar region of the affected side. The pain is reflected along the psoas muscle to the inguinal region, groin or the thigh. There is tenderness over the loin and pain is increased by walking or bending forward, and a decided curvature of the spine may be present.

There is a rise of temperature with septic symptoms and digestive disturbances, chiefly vomiting, in the acute cases. It may begin slowly with some pain and tenderness, increased on movement. If the abscess forms the pus will travel toward the least resistance, may open on the skin, or follow the psoas muscle and open on the thigh.

Diagnosis.—This must be made from pyelitis. In perinephritis no pus cells in the urine; from hip-joint disease, by limited motion of leg, and atrophy of the muscles of the thigh, and its slow onset; from Pott's disease of the spine, with psoas abscess.

Treatment.—Absolute rest in bed; light diet; incision of the abscess sac, under anesthesia, if it is thought advisable. An exploratory puncture can be utilized at any time. Application of an ice bag before pus has localized will be beneficial.

ACUTE PARENCHYMATOUS NEPHRITIS.

Synonyms.—*Acute Bright's disease; acute exudative nephritis; catarrhal nephritis; acute desquamative nephritis, acute tubular nephritis.*

Etiology.—This form of nephritis may be *primary* or *secondary*, but is more frequently *secondary*. Primary nephritis is rare. Holt has collected 24 cases from his practice and from literature. I have seen but one case in my own practice with recovery. Undue exposure is the most frequently reported cause of the primary form, though no cause may be found.

The *secondary* form is generally due to one of the exanthemata or infectious diseases, scarlet fever and diphtheria being the most frequent causes. In various epidemics of scarlet fever the number of cases of complicating nephritis vary from 5 per

cent to 70 per cent. It may occur as a complication in septic conditions from any cause, notably in gastrointestinal diseases, in which the colon bacilli and streptococci are present. The pathological condition may be caused by the organisms themselves or their toxins. Among other causes may be exposure to cold, and the continued administration of certain drugs, having an irritative effect upon the kidney as potassium chlorate and the phenols.

The active cause of the inflammatory condition of the kidney in the infectious diseases is the irritating effect of the toxins on the parenchyma of the kidneys.

Pathology.—The epithelia are degenerated, the kidney stroma infiltrated to such an extent that the kidney is enlarged and softened. The capsule is not adherent. The surface of the kidney is deeply injected, as are the pyramids on section. The tubules are dilated and contain blood cells and epithelia. Under the microscope the tubular cells show degeneration and cloudy swelling.

Symptoms.—Systemic.—The onset is generally abrupt. In the very young uremic symptoms may be manifest early by the attack being ushered in by a convulsion; vomiting and sometimes diarrhea are present early. If occurring as a complication of the exanthemata, the symptoms begin about the third week. There is a sharp rise of temperature, the pulse correspondingly rapid, and the tension quite high. Edema is present early, in the face, perhaps only the eyelids, the legs and thighs. Ocular symptoms may be present early, spots before the eyes or even blindness. Headache is prominent and anemia quickly appears.

Focal.—The *urine* is very scant, cloudy and high colored. The specific gravity is high, and albumin is present in considerable quantity, usually larger if the amount passed is small. The quantity of urea is greatly diminished.

Microscopically, all varieties of casts, large and small, are found, and free-blood cells also. If the urine is abundant, the casts may not be as numerous.

In the secondary form the symptoms usually present late in the disease. After having been afebrile the temperature rises

again, it is more irregular, and not quite so high, the child quickly appears sick again, after an apparently satisfactory convalescence. There is vomiting, headache, restlessness, edema, and much the same urinary symptoms as in the primary form.

The *duration* in the primary form is from three or four days to two weeks, and in the secondary form a slightly longer period.

An improvement is first noticed in the amount of urine passed, lessened amount of albumin, fever, renal derivatives, and gradual improvement in all the symptoms.

Prognosis.—The younger the children the graver the prognosis. Either form of nephritis is very serious in the young. Albumin and casts may both persist for some time after the acute symptoms subside.

Complications.—Endocarditis, pericarditis with effusion; meningitis; edema of the glottis or pneumonia may occur.

Treatment.—Prophylaxis.—During the infectious diseases, prevention from exposure to cold; a carefully regulated diet in which milk should predominate; regular actions from bowels; plenty of water to flush the kidneys; keep the skin active by warm baths. Close confinement to bed in these infectious cases may often prevent kidney involvement.

Management.—Diagnosis having been made, active treatment must begin with promptness. The following indications are to be met: (*a*) Relieve kidneys of the extra work of draining the serum from the tissues, as well as from excreting the retained products of tissue metamorphosis; (*b*) restore the kidney to its normal condition; (*c*) by careful and intelligent medication and diet prevent further damage to the diseased organs; (*d*) rest in bed.

Diet.—The bulk of the diet, though not exclusively, should be milk, whole, or in the form of buttermilk, made from fresh milk. To this should be added well-cooked cereals and toast with butter. Plenty of water should be given also.

Medicinal.—*Calomel* is a sheet anchor in the treatment of acute nephritis; it is an admirable diuretic, as well as acting upon the upper bowel. It should be repeated at intervals of several days. The initial dose should not be less than 2 grains. Later salines, citrate of magnesia, rhubarb and soda, cascara

sagrada, or compound jalap powder, can be tried. Nitroglycerine in high temperature, vomiting and high-tension pulse. *Chloral* may be given for the nervous symptoms.

Digitalis is of great service, relieving the heart and assisting the kidney also. Infusion is of service; fat-free digitalis yields good results, 5 minims to child of one year; strychnia, caffeine and nitroglycerine can be used to advantage for the heart.

Water, by the mouth if possible, enteroclysis or hypodermoclysis, is of great assistance.

If *edema* is great, diaphoretic measures can be used to advantage. Hot wet-packs and the hot-air apparatus bring on a wholesome sweat, with relief of symptoms promptly. *Pilocarpine* should be used with great caution.

Dry cups over the loin may aid in relieving renal congestion. *Blood-letting* has been advocated, and in one of my cases was used with decided benefit. From 2 to 5 ounces can be removed without deleterious symptoms, in child of three years.

In *convalescence* iron is early indicated in order to combat the anemia, which is usually present. At this time acetate or citrate of potassium can be used to advantage.

The urine must be constantly watched and the first evidence of increasing trouble instead of an improvement calls for prompt attention.

CHRONIC NEPHRITIS.

Types.—*Chronic parenchymatous nephritis. Chronic interstitial nephritis.*

Chronic Parenchymatous Nephritis.

Etiology.—Comparatively rare at any age of childhood, more common late. It occurs more often as sequel to the acute nephritis than as a primary condition. Prolonged sepsis, alcoholism, congenital syphilis, malaria, chronic gastrointestinal inflammations, etc., are mentioned as causes.

Pathology.—This is essentially the same as in adults. There is an enlargement of the kidneys due to new connective tissue, and they are white and nodular in appearance.

Symptoms.—Usually this form originated from the acute variety there simply being an amelioration of the acute symp-

toms, or perhaps a disappearance of them entirely for a short while, and their reappearance in this form.

The symptoms are insidious, until the dropsy is a feature, no special attention being given the kidneys. There is headache and neuralgia, lassitude or weariness, loss of appetite, vomiting, anemia. The dropsy varies in amount, but usually is quite marked, especially of face and extremities. It may be present for a time and disappear.

The urine is usually diminished in quantity, though it may be normal or increased. Specific gravity is low, and albumin present in considerable amount. The total urea output is greatly reduced. All the renal derivatives may be present, but granular epithelia are more numerous. The duration is very variable. It may last for years. It is essentially a chronic disease.

Diagnosis.—This may be very difficult. It will certainly be made much oftener when the profession as a whole realizes the importance of frequent examination of the urine in all cases of illness in children. Any progressive anemia with digestive disturbance, loss of weight and beginning edema should make one very suspicious of the kidneys, and call for an examination of the urine.

Prognosis.—The outlook is decidedly bad. The course of the disease is chronic with occasional acute exacerbations. It is usually one of these acute attacks which carries the child off. Some cases apparently recover after months of invalidism.

Treatment.—General Management.—Protection from exposure is most essential. Warm, part-wool underclothing should be worn. Careful regulation of the diet, milk, carbohydrates, cooked fruits, buttermilk and cereals can be used. Red meats, eggs, fish, animal broths, should be avoided. The bowels should be carefully watched. Occasional purgation is indicated with irrigation of the colon and warm baths; water should be given freely.

Renal decapsulation, according to the operation suggested by the late Dr. G. M. Edebohls, has been advocated, several successful cases being on record. It is an operation which should be done with great caution.

Chronic Interstitial Nephritis.

This is an extremely rare condition in older children and practically unknown in infants.

Etiology.—Syphilis, malaria, tuberculosis, have been named as causes.

Pathology.—These kidneys are smaller than normal. The capsule is adherent and there is a proliferation of connective tissue. If the connective tissue presses upon the tubules a condition of hydronephrosis is caused.

Symptoms.—This form is more insidious than the others. The child loses in weight continuously and is anemic. Gastro-intestinal symptoms are prominent, vomiting is frequent; headache is present, and eye symptoms, as double vision, specks before eyes, or complete blindness, may occur. There is usually no rise in temperature, but there is a high-tension pulse, and the left heart shows dilatation.

The *urine* is increased in quantity and specific gravity is low. Albumin is present in small quantities and may be only occasionally found or absent entirely. The principal casts present are the hyaline, though the other varieties, in the presence of an acute exacerbation may be found.

Prognosis.—This is always bad. The tendency is to a fatal termination, though it may show an improvement occasionally. The duration may be two or three years.

Treatment.—Not a great deal can be accomplished save the care of the child, protection from exposure and carefully regulate the general functions of the body. The diet should be chiefly milk, but occasional meals of more or less general character must be given, if anemia is a prominent symptom. Change of climate is often of great benefit.

TUMORS OF THE KIDNEY.

Varieties.—*Benign* tumors of the kidney are very seldom seen. The vast majority of this form of growth are malignant, and the commonest variety is a *sarcoma*. Any portion of the kidney may be primarily involved, with secondary involvement

of other organs, as the liver, spleen or lungs. A variety of growth has been described by one author as embryonal adenosarcoma.

Etiology.—These growths are essentially peculiar to children, occurring usually between six months and four and a half or five years of age. It is rare to see one in children over five years of age. It does not occur oftener in one sex than another. The left kidney seems to be more often affected. The direct cause is not known.

Symptoms.—The condition may not be recognized until the growth is visible to the eye. Preceding this time the cachexia is quite marked, there is apt to be pain and occasionally bloody urine.

In the presence of the latter conditions a careful palpation should be made of the abdomen, and the tumor will probably be found. At first its growth is slow, but when easily palpable the tumor enlarges with greater rapidity, and may apparently fill the whole abdominal cavity in a short while. The feel of the tumor is usually soft, not fluctuating, but a distinct *give* to it.

Bloody urine is a very common symptom. It may be demonstrable only by the microscope, but is present in practically all cases. Albumin is present, principally because of the blood. Hyaline casts are sometimes found.

The first symptom to call attention to the child may be a distinct cachexia, a something in the countenance and the skin which usually suggests malignancy, a different color from the anemia of tuberculosis. The child loses flesh rapidly and the prominent abdomen soon becomes a marked symptom.

Pain more or less severe is present in practically all cases. It may be simply a dull but persistent ache or a severe darting pain, enough to make the child cry out.

Diagnosis.—A diagnostic sign usually present is the localization of the colon, shown by a tympanitic note over the surrounding dull area.

Kidney tumors are the most frequent of abdominal tumors in children.

Prognosis.—The course of malignant tumors of the kidney is

always fatal if not operated upon. Early operation yields good results. Unoperated cases die within six months or two years. The earlier the diagnosis and operation the greater the chance of recovery.

Treatment.—This is essentially surgical as no other treatment offers any results. Pain usually requires anodynes; paregoric, heroin, codeine or morphia may be given.

Removal of the kidney and ureter for some distance offers the only hope of recovery, and the earlier this is done the better the outcome.

HYDRONEPHROSIS.

Definition.—This is either congenital or acquired, and is either a cystic degeneration of the kidney or an accumulation of urine in the pelvis of the kidney from an obstruction of the ureter.

Etiology.—The obstruction of the ureter at any point in the ureter, may be caused by the lodgement of a stone from the kidney or contraction of the vesical orifice of the ureter. Obstruction of the ureter from pressure by tumors of other organs may be a cause.

Pathology.—A tubule of the kidney may become blocked and dilated, forming the beginning of a cyst. If obstruction of the ureter is present the pelvis of the kidney becomes dilated and the cortical portion of the kidney pressed upon until it is a thin shell. The kidney is larger than normal, but not as large as a malignant growth. A double hydronephrosis may be present in which case the obstruction is most likely low down.

Symptoms.—These are very vague, and usually no diagnosis is made until the tumor is felt. It occurs later than the malignant growths as a rule. The presence of the urinary findings of nephritis may obscure the true diagnosis.

Prognosis.—Without surgical intervention the prognosis is grave, and in the double variety the end comes quickly.

Treatment.—This is entirely surgical, and when but one kidney is affected, a nephrectomy being indicated in all cases. Drugs have no place in the treatment.

ENURESIS.

Synonyms.—*Bed-wetting; incontinence of urine.*

Definition.—This is a continuance of the infantile habit of vesical incontinence into the third year.

Etiology.—The control of the bladder is a complex phenomenon. With distension of the bladder the impulse for evacuation passes from the nerves in the bladder wall to the cord and brain, and the impulse to the muscles of the bladder is carried back through the nerves; this causes relaxation of the vesical sphincter, and the contraction of the muscles of the bladder follows.

Enuresis occurs in various organic diseases of the central nervous system; from irritation of the nervous centers, in the cord or brain, and of the nerves in the bladder; inflammatory change in the bladder mucous membrane; congenital bladder malformations; abnormal urine, especially a hyperacidity; too free taking of fluids at bed time; vesical calculus; phimosis; urethritis; vulvovaginitis and urethritis; extreme nervous conditions, especially chorea; anemia; constipation; weakness of the sphincter vesicæ.

The oldest child I have seen with enuresis was a boy of 13. Enuresis may be nocturnal or occur only during the day, or may occur both day and night.

Symptoms.—The chief symptom is the involuntary passage of urine, which may occur once or several times during the night. If it occurs only during the day the child may be able to retain the urine only an hour or so. Frequently an accidental passage of urine occurs while the child is intent upon its play, and this should not be classed as an enuresis.

The habit may continue until puberty, if treatment is not instituted.

Prognosis.—The earlier the treatment is begun, the better the results; the correction of malformations yields prompt results. If there is an organic brain lesion the prognosis is not good.

Treatment.—Examine carefully into any cause, mechanical or otherwise, which is removable, and first correct this. Usually no other treatment is needed. Reflection of the prepuce or cir-

circumcision in severe phimosis relieves one source of irritation, and while of itself does not cure many cases, is a great help. Build up the child; correct dietary indiscretions; limit the amount of water drunk after 6 o'clock in the evening; awaken the child at 10 o'clock to empty the bladder; assist it to sleep upon the side and not upon the back by wearing a knotted towel about the waist with the knot in the lumbar region; raise the foot of the bed to cause the urine to distend the summit of the bladder and not make undue pressure upon its neck; cool bathing, followed by a rub, is beneficial also. A bland diet, especially at night, should be insisted on.

Medicinally belladonna gives the best results, and it can be given in the form of the tincture, the initial doses of 1 drop for each year of age, three times a day, increased a drop a day until the physiological effect is obtained. The dose is then decreased 10 per cent and kept at this for a week or so, then decreased 1 drop a day until it is discontinued.

Hexamethylenamine, salol or citrate of potassium may be of benefit. Ergot in small doses is of value in cases due to weak bladder muscle, five minims of the fluid extract three times a day to a child five years old.

Atropia can be given as follows:

℞ Atropiæ sulphatis	gr. ss
Aquæ destillat	ʒi
M. et ft. solutio.	

Sig. One drop for each year of the child's age at 4, 5 and 6 o'clock in the evening. Strychnia can be added to the above prescription in proper dose.

PHIMOSIS.

A congenital phimosis, or contracted prepuce, exists in all male children, but with the growth of the glans penis, the adhesions are loosened and the accumulation of smegma behind the corona glandis separates them at this point.

If from birth to the fourth week the prepuce is pushed back a little farther, daily, by the end of that time it can be easily pushed back over the corona glandis and the smegma removed. This preliminary and complete stretching and reflection dilates the prepuce sufficiently to make the complete uncovering of the

glans easy, and obviates the necessity for circumcision. This reflection should be repeated once a week, some vaseline placed behind the corona and on the glans and the foreskin replaced. The necessity for replacement of the foreskin promptly after its reflection should always be borne in mind as a paraphimosis is easily produced.

Symptoms.—There may be no symptoms except pain on voiding urine or straining at that time without pain. The straining may be so great as to cause a prolapse of the rectum. Reflex symptoms are not uncommon when adhesions are present. I have seen one boy presenting symptoms of hip-joint disease which were completely relieved after the preputial adhesions were broken up. Night terrors and epileptiform convulsions may be caused by phimosis as well as choreic symptoms. Enuresis has been attributed to phimosis, but other observers report little relief from this condition by circumcision or correction of the trouble by reflection of the prepuce.

Treatment.—None of these symptoms will present if early retraction is done, but if there is a pin-point preputial orifice which is very tight a circumcision should be done, with the entire removal of the prepuce. A dorsal incision of the prepuce should never be performed in lieu of a circumcision.

PARAPHIMOSIS.

This usually occurs in infants as the result of a reflection of the prepuce, the foreskin being allowed to remain behind the corona glandis too long. As a result a strangulation occurs, and a swelling of the folds of the prepuce quickly takes place. The swelling may be very great, the skin and mucous membrane become reddened, and later may become black if the condition is not relieved. Considerable pain is present and there may be difficulty in urination.

Treatment.—Manipulation may succeed in reducing the deformity. The penis is encircled just back of the corona glandis by the fingers of one hand and the other holds the glans, firm pressure being made simultaneously for several minutes. The position of the hands is then changed and pressure is made upon the glans and corona glandis by the thumbs

and index fingers, an attempt being made at the same time by the other fingers to draw the foreskin forward.

If these manipulations fail, while the penis is flaccid and much of the blood has been forced out by the manipulations, the constricting bands are divided on the dorsum of the penis in the median line, the reduction then being easily accomplished.

HYDROCELE.

Definition.—An accumulation of serum in the sac surrounding the testicle or in the peritoneal extension in canal of Nuck of the female. It may be congenital or acquired.

Symptoms.—In hydrocele of the tunica vaginalis there is a gradual enlargement of one side of the scrotum, occasionally of both sides. The tumor is tense, fluctuation can be demonstrated, it is translucent, and can not be reduced into the abdominal cavity.

The *congenital* variety is reducible, the opening at the internal ring being patent.

Treatment.—No treatment may be needed, the fluid being spontaneously absorbed. When very tense aspiration should be performed, the inside of the sac wall being rubbed with the point of the canula, and an obliterative traumatic inflammation set up. The practice of injection of carbolic acid into the sac is not to be commended in children.

BALANITIS.

This is an inflammation of the mucous membrane covering the prepuce and glans penis.

Etiology.—Neglect of the foreskin, uncleanliness, infection, trauma, masturbation, urethritis with confining of the secretions, and decomposition of the smegma. It occurs most often in a phimosis.

Symptoms.—The first symptom noted will be an enlargement of the penis, principally near the end of the foreskin. If there is a phimosis the end of the prepuce seems smaller than usual. A discharge may be noticed, in the absence of a urethritis, coming entirely from the mucous membrane of the prepuce and glans. It may be due to a decomposition of the smegma, or

an infection after reflection. I have seen one case in which a small abscess formed behind the corona from this cause, adhesions having formed around the pus and limiting it to a small area. Reflection of the prepuce, breaking up of the adhesions and cleanliness caused a prompt cure.

Treatment.—Perfect cleanliness is indicated. Boracic acid solution is effectual. Circumcision should be performed where there is enough constriction to prevent free exposure of the glans for cleansing, not however until all inflammation has subsided. It may be necessary to make a dorsal incision to accomplish free drainage, with a complete circumcision later.

URETHRITIS.

This is an infection of the urethra, and may be *simple*, due to the ordinary pus-producing organisms, or *specific*, due to an infection with the gonococcus. A bacteriologic examination may be necessary to make the differential diagnosis. It may affect both male and female babies, but is more common in older children.

The simple form is rarely severe. There is an invasion of the urethra from a balanitis, or a simple vulvovaginitis. In the male the infection is usually limited to the anterior urethra or the fossa navicularis. Combined with a balanitis the condition is much more serious. There is pain on urination, the child shrinking from a voluntary passage of urine. The discharge is not very profuse or the duration of the inflammation very long.

Treatment.—Hexamethylenamine by the mouth for the purpose of rendering the urine bland and unirritating, plenty of water drank, is about all that is needed. No local treatment is indicated as a rule. In obstinate cases it may be necessary to use an application of a 5 per cent argyrol solution.

Gonorrheal Urethritis.—Unfortunately this form of infection is met oftener than is the general belief. It not only occurs among the poor, who live in unclean and unhygienic surroundings, but in the children of the well-to-do, who may employ a nurse who has the infection and is guilty of abnormal practices with the child, or may be transmitted through the medium of a

towel or wash cloth. It occurs in boys most often between six and ten years of age.

Diagnosis.—The only safe diagnosis is by examining the stained urethral discharge under the microscope. All urethral discharges should be examined in this way for diagnosis.

Symptoms.—A profuse, thick, creamy discharge from the urethra is present. There is pain on urinating, which may only be at the passage of the first few drops, or accompanied by severe tenesmus upon the completion of urination. The penis is usually swollen and tender.

The chief complication to be feared is conjunctivitis because of the carelessness of the child. Orchitis, epididymitis and arthritis are uncommon in children.

Treatment.—This does not differ in any essential from a specific urethritis in an adult, except that urethral irrigation is impracticable. Water, taken freely; hexamethylenamine, gr. iii to v, in boy of six; santal, 5 min., will be found of service. A balanitis, complicating, also demands attention.

In the specific cases the gonococcus vaccines may be used with benefit.

Attendants should be warned against the possibility of infection of the eyes by the discharge.

VULVOVAGINITIS.

This is an inflammation of the mucous membrane of the vulva, with secondary involvement of the urethra, vagina and possibly the cervix. It is *simple* or *specific*, the latter due to gonorrhea.

Etiology.—The *simple* form is usually due to uncleanness; using the same napkin several times after it is wet before it is washed; pin-worms, or other infection from the rectum as the colon bacillus; the exanthemata; in institutions where the same towel is used by a number of children; trauma and masturbation.

The *specific* form is due to an infection by the gonococcus, of Neisser, and in every case of vulval inflammation the discharge should be carefully stained and examined microscopically. It is usually conveyed by a towel or washcloth, infected by an adult, similarly affected. A mother may innocently have a

latent gonorrhea, cervical or vaginal, and infect the child direct through the medium of the hands. I have had three cases recently. In one the father, in another the brother had an acute attack at the time and infected a towel, in the second the closest questioning has failed to reveal the source of contagion, though a colored nurse was strongly suspected.

Symptoms.—The *simple* form may present few if any symptoms, except a discharge. This may amount to very little, save a slight staining of the clothes. The vulva may be slightly congested, but usually this is not at all severe.

Glandular enlargement in the groin may be noticed, with or without pain.

In the *gonorrheal* form the process is rarely limited to the vulva, the invasion of the vagina and cervix being usual, as well as of the urethra, evidenced by tenesmus, frequent passage of urine or a desire to do so. There is a burning and itching. The discharge is quite thick and creamy, there is apt to be a sticking together of the labia, and an accumulation of pus in the ostium vagina. After a time there is no pain or discomfort, the only thing being the disagreeable discharge of pus. There usually is an enlargement, sometimes painful, of the inguinal glands, which may keep the child from walking or crawling.

The specific form lasts longer than the simple, usually from four to six weeks. The last case I had under my observation was in the two-year-old child of a most intelligent and faithful mother, with a persistence of the discharge for nearly seven weeks. The examination of some of the secretion about the vulva is the only way that the progress of the case can be reckoned.

Complications.—Atresia of the vagina may occur; conjunctivitis, orchitis, epididymitis, inflammation of the glands of Bartholin, arthritis, inguinal adenitis, salpingitis, peritonitis.

Prognosis.—This is good, but the duration is usually longer than in the simple form, averaging four weeks and often much longer. Diagnosis can only be made by a microscopic examination of the pus and should be done early.

Treatment.—The vulva and vagina should be carefully irrigated with a 1:5000 bichloride of mercury solution, followed

by a solution of nitrate of silver, 2 per cent; Argyrol, 2 to 5 per cent solution, can be used instead of the nitrate of silver. Extra precautions should be taken to limit the possibility of an infection of the eyes, as this is apt to take place unless most careful precautions are taken.

The inoculation treatment of specific vulvovaginitis has been used with some success.¹

The patient's opsonic index is taken every other day according to Wright's method. At first the index should be compared with that of several healthy boys.

The tolerance for the vaccine by the different patients varies, but an average of 1,000,000 is given and increased according to the index gonococcus. Local reaction usually takes place at the site of injection, as an indurated tender area. A general reaction is rarely seen. The injections are given every fifth or sixth day and should be guided by the index. The conclusions reached from observation of a large number of cases is that the vaccine treatment shortens the duration of an attack; that old strains are more effective than fresh ones; that the serum treatment is not to be recommended.

The diet should be unirritating and nourishing; water taken freely between feedings.

Because of the possibility of involvement of the scrotum and contents in male infants, the child should be kept in bed entirely during the acute stage.

Treatment should be continued as long as there is any discharge, and discontinued only when no cocci are found on microscopic examination of the vulval secretion.

CYSTITIS.

This is an inflammation of the mucous membrane of the bladder. It rarely occurs as a primary condition but most frequently as a result of a calculus in the bladder, or secondary to a balanitis or urethritis, the latter usually of specific origin. It may be due to a direct invasion of the colon bacillus.

Symptoms.—There is a distinct history of frequent and nearly always of painful micturition, which has lasted a variable length of time. Mild cases may not complain of pain. There

¹ Churchill-Soper: Journal American Medical Association, vol. li, no. 16.

may be pain in the perineum of the male and discomfort or pain in the lower portion of the abdomen in both sexes.

The urine is acid if the colon bacillus is present, cloudy and contains epithelium and pus, probably a trace of albumin and many bacteria. Blood is present also, if there is a mixed infection.

Prognosis.—Prompt recovery is the rule, except when the infecting organism is the gonococcus.

Treatment.—Usually rest in bed, milk diet, copious drafts of water and hexamethylenamine, in from 3 to 5 grain doses, is all that is needed. In very acute cases, with painful urination, an anodyne may be needed. Bladder irrigation is not always necessary; when indicated a boracic acid solution, 1 or 2 ounces at a time, can be introduced and immediately withdrawn.

UNDESCENDED TESTICLE.

Cryptorchidism.

During the early months of intrauterine life the testicles rest in the abdominal cavity, postperitoneally, just below the kidneys. They pass downward and enter the scrotum, through the inguinal canal about the ninth month of intrauterine life.

The testicle, one or both, fails to descend into the scrotum in the proportion of about 1 in 500 cases. It may be interrupted in its descent and remain in the cavity; lodge at the internal ring; or it may lodge in the inguinal canal.

Cases in which the lodgement is in the cavity demand no interference, but those which lodge at the internal ring or in the canal the indication for interference is present, as the organ may become injured; inflammatory conditions of the cord and testicle are more apt to occur, and hernias prone to develop.

For the relief of this condition Bevan¹ has suggested operative procedures as follows: An incision 3 inches long over the inguinal canal dividing skin, fascia and external oblique aponeurosis. A pouch of peritoneum is found under the external oblique extending from the abdominal peritoneum through the canal to the scrotum, even in cases in which the testicle has remained in the cavity. The pouch of peritoneum is opened,

¹ Keen's Surgery, vol. iv.

cutting through the thin layers of cremasteric muscle and fascia and transversalis fascia. Transverse division of the vaginal process is made above the testicle and the upper end closed with catgut. The lower end with a purse-string suture, thus making a tunica vaginalis for the testicle. The peritoneum is wiped from the cord with a sponge, and the fibrous strands in the cord torn with fingers or forceps, the cord being freed of everything but the vas and vessels. If the testicle will not reach to the bottom of the scrotum, it may be necessary to ligate and cut the spermatic artery and veins. Blunt dissection of the peritoneal pouch with the finger may be necessary to allow the testicle to be pushed in, where it is retained by a purse-string suture within the neck of the scrotum. The wound is then closed as in any hernia operation.

The age for performance of this operation is between 5 and 12 years of age.

CHAPTER XXI.

NUTRITIONAL DISORDERS.

ATHREPSIA.

Synonyms.—*Malnutrition; marasmus; inanition; wasting disease, infantile atrophy.*

Etiology.—This condition develops most frequently as a sequel to the acute gastrointestinal disorders, in which the digestive disturbance becomes chronic.

It is characterized by atrophy of the tissues and a progressive loss in weight and strength. Heredity plays an important rôle in the etiology. Weak and delicate parents have poorly resisting offspring.

Environment is a decided causative factor. Children in overcrowded tenement districts, with badly ventilated sleeping quarters, who get but little fresh air and have poorly prepared food, are liable to develop this condition.

The most important cause is the food. The food itself may be all right but its mode of preparation, method of administration and quantity may result in an intestinal intoxication with resultant malnutrition.

It usually begins after the sixth month of life, and reaches its height before the second year, if the child survives this long. It is rarely seen among children who are breast fed.

“Hospitalism” is sometimes the cause. For some unknown reason a child may not do well in an orphan asylum, and if its surroundings and environment are changed without change of diet they do well.

Pathology.—There is no distinct pathology to this condition; coincident with the general atrophy and wasting of the tissues there is an atrophy of the glandular structure of the digestive tract. There is a condition of *lymphatism*, an enlargement of all the lymph nodes of the body, especially of the mesentery, solitary glands of the intestines and the bronchial glands.

The subcutaneous fat is absorbed and the skin of the body is wrinkled and lies in folds. As the condition progresses, the skin of the face becomes tightly drawn over the bones and the child assumes the old-man appearance which is so characteristic. Hemorrhages may occur in the skin or the mucous membranes, especially of the intestines.

Symptoms.—In every case of acute gastrointestinal disorder the possibility of its terminating in a condition of athrepsia should be borne in mind, and the child put on a gaining diet at the first possible moment, without overtaxing the digestive capacity. The child's weight is the best guide as to the importance of this. A progressive loss in weight each week is an indication for increased watchfulness.

Athrepsia is essentially an insidious condition, reaching an alarming proportion in a period extending over several months.

There is a progressive loss in weight; the subcutaneous fat disappears and the skin lies in folds; it is harsh and dry to the touch; the abdomen soon becomes distended from accumulation of gas in the stomach and intestines, principally in the colon. It is restless and irritable, crying or whining constantly; the temperature is apt to be subnormal, with occasional rise, from an intercurrent intestinal toxemia or indigestion.

The bowels are apt to be constipated; but thin mucus movements are occasionally seen. It is rare that two actions passed are of the same color or consistence. They are more often green than of the normal color, and frequently contain undigested particles of food, and are universally of a foul, putrefactive odor.

Because of the irritating character of the discharges the skin of the buttocks develops an intertrigo; it is red, thickened, and may become moist if it breaks down.

Dentition is delayed and a stomatitis is apt to occur; the tongue is usually dry, cracks develop at the corners of the mouth.

The child will usually act as if famished, and will take eagerly any food or water which is given. Vomiting is frequently present, chiefly owing to the rapidity with which food is taken and the over-distending of the stomach. Dilatation of this organ quite regularly results.

Diagnosis.—The differentiation of athrepsia from the less

serious forms of malnutrition is difficult, as there is no fine-cut line of difference. It must be differentiated from tuberculosis and congenital syphilis. In the former there is apt to be a rise in temperature, probably with signs in the chest if of that form. The localization of tuberculosis in any organ or structure should make the diagnosis easier. The enlargement of the lymph nodes in both forms makes this occurrence of no assistance as a diagnostic sign.

In congenital syphilis the changes in the skin and mucous membranes, snuffles, history and, as a rule, earlier development of symptoms assist in the differentiation.

Prognosis.—The condition is invariably a grave one, especially in the severer forms of the trouble. Where hospitalism is a feature the results are universally bad.

The condition is progressive and a fatal result almost inevitable.

Treatment.—A most careful inquiry must be made into the routine of the child's life, its feeding from birth, with details of the various changes in the diet, and a record made of the character, of preparation and quantity of the food given. This is most essential as the diet is so often at fault primarily.

If its environment and surroundings are at fault these must be changed. If hospitalism is present, endeavor to have the child placed in a private family or isolated in larger quarters with more air available. A change of climate is often of great benefit in children in private homes.

Regular bathing, bran baths, salt rubs, olive-oil rubs, after the water baths; careful attention to the skin of the buttocks, and to the napkins and feeding apparatus; plenty of out-of-door air; attention to the mouth, with frequent use of a boracic acid mouth wash. The most important consideration is of the food, which must be regulated as soon as the gastrointestinal tract has been placed in as normal a condition as possible. This is brought about by giving an initial dose of calomel, gr. i in $\frac{1}{8}$ gr. doses, repeated at half-hour intervals, and followed by a dose of oil.

If on the breast the milk must be examined and the deficiencies in it corrected by artificial feeding, or a suitable wet-nurse,

if possible. A preliminary examination of the milk of the wet-nurse must be made.

If on a modified milk, this should be withdrawn until after the preliminary cleaning out of the intestinal tract, a dextrinized barley water being temporarily given.

A modified milk, low in fat percentage, should be given at first, and in small quantities at two-hour intervals. As the child evidences an ability to take care of the food it can be increased both in strength and quantity. The stools must be closely watched.

The importance of obtaining a certified milk, or milk of equal cleanliness, should be emphasized. Whey is a valuable food to be used during the period of getting the child on to a gaining diet.

A prescription as follows can be used to advantage at first: Fat 0.5 to 1.0, sugar 6.0, and proteid 0.5 to 1.0, the proteid increased slightly more rapidly than the fat as the child shows evidence of ability to care for it.

The tendency is to give these babies cod liver oil or olive oil, to bring up the fat deposit in the system, but it should be given with great caution. Fats are poorly taken care of in the intestine, and the intestine can be easily overwhelmed, with these, if given in addition to the regular diet. Lavage can be used in the obstinate vomiting cases, and gavage in those cases in which vomiting continues in spite of stomach washing.

The advantage of using partially or completely peptonized milk in the beginning of these cases should be borne in mind, but should not be too long continued.

Tonics have their place in the treatment of this condition; as minute doses of strychnia, iron, diastatic agents, as pancreatine, etc., and stimulants, in certain cases may be indicated.

SCORBUTUS.

Synonyms.—*Infantile scurvy; Barlow's Disease.*

This is a constitutional nutritional disease due to prolonged error in diet. Hemorrhages are its chief manifestation, and these may be in the joints, under the periosteum or from the mucous and serous membranes, and in the tissues.

Etiology.—This is particularly a disease of infancy, being

seen most often before the second year of age, rarely before the fourth month. The diet is the chief cause, viz., prolonged use of one of the artificial foods, condensed milk, cow's milk in improper modifications, which usually has been Pasteurized or sterilized. Isolated cases have been reported as developing in children who have been on breast milk exclusively. These have been rare, however. The continued use of any food which lacks the vital quality of *freshness*, will cause scurvy.

Pathology.—The chief changes are in the blood vessels which permit of the escape of blood into the joints or tissues, or a changed blood which can escape from more or less normal blood vessels. The chief hemorrhages seen are under the periosteum of the long bones, principally of the lower extremities, in the joints, from the mucous membranes, and in the subcutaneous tissues. The bones of the arms are less often affected, but hemorrhages do occur at the ends of the ribs and on the scapula and sternum.

Numerous ecchymotic spots appear in the skin of the body. The mucous membrane around the teeth and of the gums, becomes spongy and bleed if touched. The teeth may become loosened.

Symptoms.—The child usually gives a history of doing badly for several weeks, is pale and anemic and more restless than usual. Suddenly, if it has been walking, it refuses to stand, and cries when handled. The joints become swollen and very tender, and there may be pain when the child is entirely quiet, but this is not usually the case. Examination of the legs reveals swellings along the shaft of the long bones and near the epiphyses, and the joints are swollen, usually without redness.

The skin may show a number of hemorrhagic spots, like bruises, some large, or there may be a number of petechial spots scattered over the body. Characteristic changes occur in the mouth. The gums are spongy and usually extend some distance up on the teeth, and they bleed on the slightest touch. The gums may not break down, if no teeth are present, but the mucous membrane over them usually shows a number of small hemorrhagic areas.

Melena may be present and blood in the urine is not uncom-

mon, with blood casts and albumin present also. A single or double exophthalmos due to blood in the orbit may be present, but this is not at all a constant symptom. A subconjunctival hemorrhage sometimes occurs. Discoloration of the skin around the eye, a so-called "black eye," is often present, especially when there is an exophthalmos. Hematuria is not infrequently present. In regard to the blood count in scurvy, Da Costa reports, as a result of examination of seven cases, an average hemoglobin percentage of 43 per cent, an average of red cells of 3,527,000, the average leucocytes of 15,500. In only one of the seven cases was there a leucocytosis.

Diagnosis.—The chief trouble to be diagnosed from is *rheumatism*. I have seen three such cases, each had been vigorously treated for rheumatism, and each presented the classical symptoms of scurvy. If the chief pathological conditions of scurvy are borne in mind the diagnosis is plain, as a rule, viz., hemorrhages under the periosteum and in the joints, and the typical changes in the gums. Owing to the forced immobility from the pain in the joints the legs have the appearance of being partially or completely paralyzed. The muscles are tense, to protect the leg, and have none of the true appearance of a paralysis. Occasionally there is a rise of temperature, but it is irregular and rarely high. Among the other conditions which may be mistaken for scurvy are as follows; periosteitis, osteomyelitis, hip disease, injury, difficult dentition, infantile paralysis.

Prognosis.—This is universally good if the condition is recognized early and appropriate treatment begun. Even the hemorrhages causing the exophthalmos are quickly absorbed. Delay in the diagnosis prolongs convalescence proportionately long.

Treatment.—This is essentially one of diet, no medication being required. Inquiry should be made in detail in regard to the feeding, and it should be taken off all proprietary foods, and put on fresh, unsterilized and unpasteurized cow's milk at once. If the child is under one year, the milk should be so modified that the fat and proteid contents are not too high; if over one year of age a 4 per cent milk can usually be easily taken care of.

In addition to the milk the child should be given strained orange juice, which is practically a specific, at first half an ounce twice daily, between feedings, gradually increased to 1½ or 2 ounces. One or two feedings a day of an animal broth, or the expressed juice of beef, will be found most beneficial, and one feeding of a small, baked Irish potato daily. One or two tablespoonfuls of the beef juice can be given alone or as gravy over the potato.

Careful regulation of the hygienic conditions should be made, the child kept in a bright, airy room, with plenty of sunshine. It should be kept quiet and not handled more than necessary to keep it clean, and the improvement will be decided in the course of three or four days.

Medication is, as a rule, not needed, except it be to combat the anemia which is present in nearly all cases, especially if of long standing and it does not respond to the dietetic treatment.

Iron in some form will be well borne:

R	Tinct. ferri chloridi	3ii
	Glycerini	℥ss
	Aquæ destillatæ q.s	3ii
M. ft. Sol. One teaspoonful after eating, three times a day.		

The *prevention* of scurvy is of great importance. The diet of every artificially-fed infant should receive careful supervision, proprietary foods not used, and the progress report regularly sent in for the guidance of the physician.

RACHITIS.

Synonym.—*Rickets*.

This is a constitutional disease or disorder of nutrition in which the most striking changes are in the bones, the principal site being the epiphyses, though more or less marked changes occur in every other organ and tissue of the body.

Etiology.—Bad hygienic surroundings and unsuitable food are the principal causes. Infants who are breast fed well into their second year, or who are getting a breast milk below standard in quantity and quality, or the artificially fed in whom the proprietary foods or condensed milk are given to practically the exclusion of fresh food, are prone to develop rickets. From

this we would scarcely expect to see a case before the sixth month, but cases of fetal rickets have been reported. In condensed milk, and in some of the proprietary foods also, the chief element lacking is the fat, as in any dilution recommended the fat content is low.

A history may be obtained of a previous exhausting disease, as a prolonged gastrointestinal disturbance or the exanthemata, a bronchitis of some weeks duration, always, however, in connection with some irregularity in diet or a failure to give the child a well-balanced ration, which is meeting the needs of its nutrition.

Rickets is more frequently found in the colored race than in any other, next in frequency perhaps in Italians. In both these races over-crowding, unhygienic surroundings and improper food are present.

Pathology.—All of the tissues of the body share in the nutritional changes found, but because of the prominence of the bony changes attention is chiefly focused on them. The bony changes occur in the centers of ossification and consist in the excessive deposit of cartilage at these points. In the long bones it is at the epiphyses, in the flat bones, especially of the skull, it is in the center. Owing to the deficiency in the lime salts in the cartilage cells these fail to ossify, and all the bones are soft and more or less flexible; because of this condition the fairly characteristic bony deformities of rachitis take place. Craniotabes is a characteristic condition, being a softened area to the sides of the occipital protuberance, which can be very easily demonstrated.

There is a congestion or hyperplasia of the periosteum at the ossification centers. It is easily removed from the bone. Microscopically a marked increase in the new cartilage cells is seen, and an increased vascularity of the proliferating zone.

Anemia is always present, the hemoglobin is relatively low. Morse's¹ cases averaged 63 per cent with a color index of 0.7. The red cells in his cases averaged over 4,500,000.

Leucocytosis is present in many cases, but not in all by any means.

¹ Boston City Hospital Rep., 1897.

The muscles are flabby, and the ligaments weak and easily stretched, the heart is weak and irritable.

Bronchitis and pneumonia are frequent complications, there seeming to be an almost constant state of passive congestion of the mucous membranes.

There is an enlargement of both the liver and the spleen, especially the latter. The spleen can quite easily be palpated below the costal margin.

Symptoms.—Focal.—The head of the rachitic child is enlarged, the bitemporal and biparietal diameters are increased. *Bosses* develop at the centers of ossification, chiefly of the parietal and the occipital bones. The forehead is high, and the fontanelles are both late in closing. Frequently the sutures are found ununited.

The rachitic rosary is a fairly constant symptom. This is an enlargement of the ribs at their costal margin and gives the impression of a string of beads. If these enlargements are of some size their under surfaces will make indentations on the lungs. As a result of the softening of the costal cartilage the atmospheric pressure pushes in this portion of the chest wall, causing the sternum to be more prominent. This deformity is called a pigeon breast, and is fairly characteristic.

The ends of the long bones show an enlargement, the epiphyses at the wrist being specially large.

If the child is walking, the weight of the superimposed body causes a bend in the femur and bones of the leg, as well as an exaggeration of the curves of the spine. A lateral curvature not unusually develops. Genuvalgum, a knock-knee, and genuvarum, bow-legs, are common deformities. An anterior curvature of the tibiae is often present. This is probably, in part, at least, due to the child sitting in a chair with its feet extending beyond the anterior edge, the weight of the foot causing the bend in the tibia.

At this stage of bony formation, softening of the pelvic bones may result, in female children, in a flattening of the pelvis, causing the flat rachitic pelvis which results in a dystocia in the child-bearing period.

Dentition is delayed and often difficult. After the teeth are

cut they are soft and decay early, the front teeth often crumbling away.

Systemic Symptoms.—An anemia appears early and is frequently quite pronounced.

Owing to the loss of tone of the musculature of the stomach and intestines these organs become distended, and the child presents a "pot belly." Attacks of gastroenteritis are frequent. Constipation is the rule. These conditions are chiefly due to the child eating more than it can digest and assimilate.

Head sweating is an early and prominent symptom, and when present should cause the physician to be suspicious at once. The child's pillow will be wet whenever it lies down to take its nourishment or to sleep, and its hair quite wet, with beads of perspiration on its forehead and neck, and this in spite of the temperature of the room.

It is cross and irritable, and if muscle tenderness is present it cries if it is handled or moved.

It is very restless and sleep is greatly disturbed; it will cry out in its sleep very frequently. It is often wakened at night, with a spasmodic condition of the larynx, causing a peculiar crowing-like sound. This is *laryngismus stridulus* and is a fairly constant diagnostic sign.

The child is backward in walking, due to the deficient muscular power, the muscles being soft and flabby. The association of adenoids and rachitis is not infrequent, the child being a mouth breather in consequence.

Late in the disease there is a temperature of from one to three degrees, with acceleration of the pulse rate. This is due to some intercurrent affection, particularly bronchitis or pneumonia, or gastrointestinal trouble.

Prognosis.—Rickets is a chronic affection, usually running its course in about two years, if upon the proper diet or treatment. Because of their weakened state and lack of resistance rachitic children are more likely to develop the acute exanthemata, diphtheria, whooping-cough, pulmonary diseases, etc.

Prognosis is worse in diseases of this nature in the rachitic. There may be a gradual absorption of some of the bony deposit at the epiphyses and bosses, but the deformities do not disap-

pear. The flat rachitic pelvis, the genuvarum and valgum, the kyphosis, remain during the life of the child.

Diagnosis.—In every child not doing well rickets should be borne in mind, as its earliest symptoms are vague and might go unrecognized. But if the principal symptoms are remembered the diagnosis should be easy, viz., head sweating, rachitic rosary, enlargement of the epiphyses, craniotabes, constipation, delayed dentition, restlessness at night, anemia, laryngismus stridulus and enlarged abdomen.

Treatment.—The principal indication is to learn the cause, if possible, and remedy it. If it is the feeding which is at fault it must be carefully regulated, fresh and properly modified milk given; proprietary foods must be withdrawn; scraped beef is of great assistance in building up these cases. If the quality of the breast milk is found at fault, with ample quantity, the nursings should be shorter and the child given a small artificial feeding after nursing of a modified milk with formula suited to its needs. If on modified milk the same formula may be kept up for too long a period, and be unequal to the demands of nutrition when teething has begun. This is seen very often.

If on a mixed diet, it may be found the child makes one or two meals on cereals, heavily loaded with sugar, drinks but little milk, rarely tastes meat, eats much potato and bread. The proteid and fat in its diet is greatly lacking, and this must be regulated by the use of milk, cream, scraped beef and beef juice, animal broths, eggs, and of butter in the older children.

Regulation of the child's surroundings, cleanliness and daily routine of living is of vast importance, if in the crowded districts of a city they can't get the fresh air so necessary to their vitality. These children need plenty of air and out-door sunshine. Fresh air must be in the sleeping rooms also. The daily bath is very necessary, which should be followed by a cool sponge, especially over the chest and back, for the purpose of inuring them to the changes in the atmosphere. A sea salt bath is beneficial.

Medicinal.—Cod liver oil, in these cases, is of great benefit, and it can be used either plain or in an emulsion.

The oil should be looked upon as a food as well as medicine,

and its effects closely watched. If it is regurgitated or if it is passed unchanged in the stools the dose must be lessened or it should be temporarily withdrawn. If used plain it can be given in gradually increasing doses, until the maximum dose is reached, from 5 drops to 1 teaspoonful, after meals. None of the so-called extractives of cod liver oil are satisfactory.

Owing to the lime needed in bony formation, the combinations of the hypophosphites of lime with the emulsion of oil are of benefit.

Considerable discussion has been indulged in by the pediatricists on the value of phosphorus in rickets. In my experience it has been of unquestioned benefit. It can be given either as the officinal oil of phosphorus, with olive oil or cod liver oil, in dose of $1/200$ to $1/100$ grain, three times a day. Thompson's solution containing $1/20$ grain to the drachm can be used also.

Iron in some form is nearly always indicated sooner or later to combat the tendency to anemia, and can be given in the form of the hypophosphite (ferri hypophosphis, U. S.), 1 to 2 grains, in the form of a syrup; the tincture of the chloride of iron, with glycerine; or diastiron in drachm doses. These should be given after eating.

For excessive head sweating atropia sulphate in $1/800$ grain doses can be given at bed time.

Other conditions should be treated as they arise, pulmonary, dietetic and gastrointestinal complications.

Deformities should be appropriately handled. Spinal curvatures by decubitus; tendency to bow-legs or knock-knee by keeping the child off its feet and off the floor. Deformities of the pelvis cannot be prevented except as they are arrested by the general improvement from appropriate treatment of the general underlying condition. Tendency to formation of spinal curvatures can be combated by recumbency or the use of a spinal frame to which the child is strapped for transporting.

CHAPTER XXII.

DISEASES OF THE NERVOUS SYSTEM.

GENERAL CONSIDERATIONS.

The nervous system of the new-born child differs from the older child or adult, in that it is more immature in development than any of the rest of its tissues. During the first five to seven years of its life it develops more rapidly than the rest of its body, especially as to its function. Early, the brain is unstable, there is but little inhibition of nerve force or energy, and there is also no development of the centers controlling the involuntary muscles, especially the sphincters. The nerve centers of an infant or child react to reflex stimulation much more readily than when the nervous system is mature. This accounts for the frequency of convulsions in the infant. The nervous system of the child is more susceptible to depressing influences of impoverished blood than the adults, this being specially true of girls, up to the time of puberty they are more prone to develop serious functional and organic nervous troubles.

The question of heredity, so little understood, is one to be seriously thought of in the diseases of the nervous system.

Nervous diseases are either *functional* or *organic*. Among the former are *chorea*, *convulsions* of reflex origin, *neurasthenia*, *hysteria*, in these troubles there being no pathological condition responsible for the disease. In the *organic* form there are pathologic changes in the cells and nerve tissue.

DIAGNOSTIC METHODS.

With a nervous disorder suspected, a careful, systematic examination must be made. In conditions such as chorea or hysteria, if the child can be watched at play, or while recumbent, entirely casually, without the child's attention being called to the fact that it is being watched, a much better idea of the symptoms

can be had. If the child is under constraint with a consciousness of being watched, the symptoms will be modified.

It may be necessary to have the child walk, if possible, to learn whether there are any paralyses, the character of the gait, whether there is a spastic condition of the muscles of the extremities, atrophies or deformities. The child should be made to squeeze one or two fingers of the examiner to obtain the contractile power of these muscles, to hold the hand out straight, lightly touching the open palm of the examiner to obtain any fibrillary twitchings of the muscles. The examination should not be concluded without the child is stripped and all parts of its body examined, especially the spine.

The reflexes must be tested, the most important being the following:

The Knee Jerk.—In the very young this is difficult to obtain, in older children it can be elicited. The legs are allowed to hang over the edge of chair or table and the patellar tendon struck gently with the end of the finger, or percussion hammer, as in percussion of the chest. The child's attention is diverted during this manipulation by having it clench its hands tightly together and pull hard.

The Biceps Jerk.—The child's arm is held flexed and relaxed with the thumb of the hand supporting the arm, held along the biceps. With the second finger or with a percussion hammer the biceps is struck a gentle blow direct, or the thumb is percussed and the muscle can be felt to contract.

Cremasteric Reflex.—By stroking the inner aspect of the thigh with the finger the muscle of the scrotum contracts, raising the testicles.

Sensation.—The examination for sensation should include the examination for the presence or absence of sensation of pain and the period of time which elapses before the sensation is received. A pin, camel-hair brush, hot and cold substances, are needed to elicit this symptom. The child's expression should be closely watched for the evidence of the reception of sensory impressions. This symptom is of importance in spinal cord lesions. The fontanelles should be examined and note made if they are open, sunken or bulging and tense.

Babinski's Reflex.—Irritation of the soles of the feet causes a dorsi-flexion of the great toe toward the dorsum of the foot, while the other four toes are flexed toward the sole of the foot.

Kernig's Sign.—In 1882 Kernig described a condition which is more or less pathognomonic of meningitis. It consists in the inability to extend the leg fully on the thigh, the thigh being flexed at a right angle with the trunk. It is involuntary and is not accompanied by or due to pain. Kernig considers the sign positive when the angle is 135° ; others place it at 120° or even 115° .

Morse concludes it is almost never found in infancy, either in health or disease, except in meningitis. It occurs with equal frequency at all stages of the disease. It is of no importance as a diagnostic sign between the tuberculous and cerebrospinal forms.

The vision of the child should be tested. The mother is often deceived as to this point. A lighted taper or bright object moved in front of the eyes will cause them to follow the object back and forth. The pupils are examined to ascertain if they are equal, and if they contract promptly to light stimulation. Constant movement of the eye, nystagmus, is a very striking symptom.

The hearing should be carefully tested by a sudden sound, as a whistle, or clapping the hands, being made behind the child.

Squire's Sign.—The child lying on its back, the head is grasped and slowly extended as far as possible. The pupils dilate during this and contract as the head is flexed.

Electrical Examinations.—As an aid to diagnosis electricity is of great value. The nerves of the new-born respond only to strong currents. Children are easily frightened by this test.

The examination is begun with the faradic current, one pole on the muscle to be examined, the other on the chest, and only a current strong enough to produce a contraction is used. In inflammatory and degenerative conditions of the nerves, both the nerves and muscles show a diminution in the faradic response, but the muscles may continue to partially respond to the galvanic current, and these changes are called the reaction of degeneration.

Electricity is also of value in differentiating cerebral disease and diseases of the spinal cord and peripheral nerves.

Lumbar Puncture.—As a method of diagnosis this procedure is of value, and is performed as follows: The child can lie upon its side, with head and shoulders elevated, and slightly bent forward, putting the tissues of the back on a stretch. The latter position favors the flow of fluid. The skin is thoroughly sterilized with soap and water and alcohol. A general anesthetic can be administered if desired, or local anesthesia with cocaine, Schleich's solution or kelene.

The puncture is made with an ordinary aspirating platinum needle or small trocar, 9 or 10 cm. long, and 1 mm. in diameter, which is sterilized by boiling 10 minutes. The puncture does not hurt much more than the introduction of the cocaine.

The space between the third and fourth, or fourth and fifth, lumbar vertebrae is selected, as at this point the cord is not injured. The iliac crests are on a level with the fourth spinous process, and the needle with one motion plunged to the intervertebral cartilage 1 cm. to one side of the median line. If the cartilage is located with certainty the canal is entered with the point of the needle, and to a depth of about 3 or 4 cm. The cerebrospinal fluid at once escapes, at the rate of 1 or 2 drops a second, or even slower in some cases. To make a thorough examination of the fluid 4 cc. to 5 cc. should be obtained, and should be dropped directly into the capillary tube of the centrifuge, after obtaining enough for cover-slip examination.

The normal cerebrospinal fluid is clear, and of a gravity of 1003, and contains a trace of albumin and is practically free from cells. In inflammation of the meninges the fluid is cloudy from an exudation of cells, dependent of course upon the character of the exudate. In the tubercular form there is very little cellular exudate.

Cover-glass preparations (from the fresh fluid as it is withdrawn or from the sediment in the capillary tube, the latter preferable) are stained with Wright's stain. Tothe's method of diagnosis has been given.

In *tubercular meningitis* the fluid appears clear, as a rule, except on close examination. If the test tube containing the



Fig. 83.—Locating the intervertebral space for lumbar puncture. Middle fingers on crest of ilium, index finger one-half inch above this line.



Fig. 84.—Lumbar puncture. Nurse holding sterile bottle to catch fluid.

fluid is allowed to stand upright in an ice box for 24 hours a precipitate or coagulum, wedge or funnel-shaped forms, which is fairly characteristic of this type.

If many polynuclear leucocytes are found in the sediment it is not the tubercular form. The large and small lymphocytes in the sediment indicate tubercular meningitis. The inoculation of guinea-pigs may be necessary to clear up the diagnosis of the tubercular form.

In the suppurative form of meningitis the fluid is very cloudy and contains pus cells, and a large number of leucocytes.

In *epidemic cerebrospinal meningitis* the same procedures are gone through with and the sediment examined for the *diplococcus intracellularis*.

FUNCTIONAL DISEASES OF THE NERVOUS SYSTEM.

CONVULSIONS.

Infantile Eclampsia.

This is a symptom and not a disease, and consists in a motor discharge, resulting from a cerebral irritation, evidenced by convulsive movements or contractures of the muscles of one or more parts of the body.

Etiology.—The nervous system of the child is so subject to reflex stimuli, and the inhibitory power of the brain is so poorly developed, that convulsions occur with comparative frequency. Among these stimuli are the toxins generated at the onset or during the exanthemata, toxins generated in the gastrointestinal tract, rachitis, phimosis, dentition and a host of other conditions may, reflexly, cause convulsions. When occurring during the first week or two of life the convulsion may be due to pressure on the brain from within, from a hemorrhage; later to an organic disease of the brain, as an abscess, hemorrhage, meningitis, etc.; they may be due to an hereditary condition, epilepsy, or may be traumatic. Convulsions are much more frequent during the first two years of life.

Symptoms.—The convulsions may be the first evidence of trouble, or it may present many preliminary symptoms. No two are alike, yet there are certain symptoms common to most.

The seizure is usually ushered in by a preliminary cry, the muscles of the face contract and the child at once develops tonic and then clonic convulsions of one or more parts or of the entire body. The head is thrown backward, and the back may be arched, the weight of the body supported by the back of the head and the heels, the position of opisthotonos. The eyes are rolled upward, and the pupils are dilated and fixed; there is a snoring respiration, spasmodic in character, due to the contractions of the diaphragm, and the face becomes a dusky color. If the convulsion lasts some time, deep asphyxia may be present. The tongue may be bitten in older children if protruded between the teeth. Clonic or slight convulsions follow the tetanic ones, and when quiet the child falls into a sleep or a state of coma, to waken rational or to go without regaining consciousness into another more or less severe spasm. The urine and feces may be passed involuntarily.

Prognosis.—A single convulsion may give rise to no sequelæ, but repeated ones are serious, as they may be the starting point of severe organic lesion of the brain, resulting in epilepsy. The prognosis depends very largely upon the cause of the condition. If due to the exanthemata there may be no recurrence, as early elimination removes the disturbing element.

Treatment.—The convulsive seizure must be controlled, and this can probably best be done by the inhalation of chloroform. The first thought of the mother and laity is to place the child in hot water, and much harm has undoubtedly been done by this procedure. The child is exposed unduly, and frequently burned, by too hot water being used, in the excitement. Judiciously applied the relaxing effect of a plain full bath or of a mustard bath may be very pronounced.

The next indication is to remove the cause if possible. Because of the frequency of toxins from the intestine being the cause, as soon as the child can swallow, a dose of castor oil should be administered to completely empty the intestinal canal. A colon irrigation should be given early. This may be cool if there is much fever. Rest and quiet are most essential. To prevent a recurrence the child is given one of the bromides, along or with chloral hydrate (bromide of strontium, gr. v, with chloral,

gr. iv), over a period of several days or a week or more. If unable to swallow the first dose may be given by the rectum following the irrigation and emptying of the bowel. The general treatment of the underlying physical condition is important. If there is rachitis it must be given appropriate treatment, and child kept closely under observation. If of school age, it should be kept away from school for an indefinite time.

CHOREA.

Varieties.—Several varieties of this disease are recognized under the generic term of *choreiform diseases*, the variety, however, usually indicated by the unqualified term chorea, is *chorea minor*, or *acute chorea*.

The other varieties are *chorea major*, *Huntington's* or *hereditary chorea*, *habit chorea*, *electric chorea*.

CHOREA MINOR.

Synonyms.—*St. Vitus' dance*; *Sydenham's chorea*; *acute chorea*.

Definition.—A neurosis, occurring almost exclusively in children before puberty, characterized by involuntary movements and twitchings of muscles or groups of muscles of the body.

Etiology.—There is unquestionably a close relationship between this disease, rheumatism and tonsillitis. Among the other diseases which bear a causal relationship are the exanthemata, tonsillitis, diphtheria. There may not be a distinct history of rheumatism, but of vague pains in the joints, which without close questioning would probably not be mentioned in the history. The occurrence of heart lesions in chorea, reported by many observers, is a further confirmation of this theory.

The majority of cases occur between the ages of 10 and 15 years. Girls, about the age of puberty, are more prone to develop it. Unhygienic surroundings with poor food, which leads to intestinal intoxication, are predisposing causes frequently seen. Crowding at school, both as to the number in the classes and the amount of work accomplished, may act as causes. Heredity is also a factor. Either direct history of chorea in the mother or a mother of an excessively nervous temperament may

be elicited. Dr. Weir Mitchell has claimed that a larger number of cases occur in the spring of the year. A sudden shock to the child, as a severe fright, may induce an attack.

Pathology.—No characteristic or constant change has been found in the nervous system in those cases which have been examined at autopsy. Among the changes reported by different observers are the following, vascular changes, as the result of an infection; cortical changes of an indefinite kind, chiefly a calcification of the ganglion cells (Golgi); connective tissue in the spinal cord and nerve centers (Garrod); calcification of ganglion cells (Golgi); hyperemia of the brain and cord, and simple changes in the serous membranes. Tonsillitis and endocarditis may be found.

Symptoms.—In the mild form of chorea there may be few or no prodromal symptoms, perhaps a short period of irritability or depression, in which the child cries easily and without provocation, followed shortly by a contraction or twitching of a group of muscles. This may evidence itself by a spasmodic winking of the eyes or jerking of the facial muscles, usually of one side or a jerking or raising of the arm or shoulder. The muscles of the hands soon become involved and the child drops articles without cause, it appears awkward at the table and handles eating utensils clumsily. If the lower extremities are involved it may walk jerkily, a peculiar gait, which is almost indescribable. The tongue is affected, even in the mildest form, and the speech may be halting or stammering and thick. This is especially true if the muscles of the larynx are involved.

The choreic movements usually cease entirely during sleep, and may do so even in the severe forms.

Relapses are very common. These may occur in a short time or a year or more may elapse between attacks. The duration is very variable, from a few weeks to several months, depending largely upon the time at which treatment is begun.

Severe Chorea.—This form is essentially like the mild, except in the extent of muscular involvement and the severity of the twitchings and contractions.

One case under my observation was admitted to the female ward of the City Hospital during my service. She was a girl 13 years of age, with a

history of severe chorea for about a month. She had severe, general convulsive movements, with traumatic bed sores upon the heels, hips, elbows and shoulder blades. Until the contractions could be controlled it was necessary to put padded sides to the bed to keep her from falling upon the floor. Mild twitchings were present during sleep.

Diagnosis.—Posthemiplegic Chorea.—Choreiform movements may follow the cerebral palsies of infancy. They are usually of one extremity. Contractures occur as a rule in this form, followed by paralysis of the part. Epilepsy, hysteria, habit chorea, must be borne in mind and eliminated by exclusion.

Pericarditis may occur, but is rarely seen.

Treatment.—The first indication is to put the child to bed and at a complete rest, without a pillow, and with no book or other form of amusement. These patients invariably do better if removed from home, mother and friends, or if this is not possible put to bed at home, and in charge of a competent trained nurse, with family and friends excluded. This is very often difficult of accomplishment, and will be looked upon as inhuman and cruel by the average mother, but by firmness, yet with tact, it can usually be done.

This complete rest and isolation does more toward obtaining a cure than any other form of treatment, medical or otherwise. Some, and very often all, of the opposition to this rest may come from the patient, but it is usually overcome in a few days.

The diet should be simple, regular and nutritious. Milk should, perhaps, be the basis of the diet, with later, eggs, farinaceous food and vegetables.

Gentle rubbing or massage following a daily warm bath is a valuable adjuvant in treatment. In some cases the galvanic current is of benefit. Bran and salt baths are of assistance.

Medicinally, no one remedy offers the same advantages as arsenic. A useful form is Fowler's solution, and it should be given in very gradually increasing doses. Begin with 1 to 3 drops after meals and increase 1 drop a day at first then increase 1 drop each dose. If given in this way it can be increased to a much larger dose before physiologic effects are noted.

Physiologic effects may show, as a puffing of the eyelids, usually the lower, or gastric and abdominal pain, cramping in character. Both symptoms may not be present in every case.

In the case of the severe form referred to, the maximum dose reached, was 1 teaspoonful. It was then decreased in amount to 20 drops at the same ratio as increased (1 drop each dose), at which time she was practically well, was up and walking about the yard.

In one case, a boy of nine years, an inmate of an institution under treatment for his second attack of chorea, the arsenic was continued in increasing doses until 20 drops was reached before physiologic symptoms were noted. Instead of decreasing at this time, as customary, the maximum dose was continued after the boy was dismissed from the institution infirmary. After taking the maximum dose for three weeks it was noticed he could not keep up in the school line because of a shuffling and hesitating gait. He was seen a few days later and a neuritis of both lower extremities found. This was evidenced by delayed sensation of the foot, partial paralysis of the legs, and the reaction of degeneration of the muscles below the knees under static electricity. After discontinuance of the arsenic he has greatly improved, but at the end of three months is still quite lame.

Symptomatic treatment in all cases is indicated. Attention to the bowels is very necessary. Nightly doses of aromatic cascara are usually of great benefit. Enemata may be indicated.

In the severe forms, in which there is a great muscular movement, the child must be controlled by the hypodermic administration of morphia, the dose appropriate to the age.

The temperature should not be taken in the mouth from danger of the thermometer being broken.

The child should be kept from school for several months *after apparent restoration* of health.

HEREDITARY CHOREA.

Synonyms.—*Huntington's chorea; chronic chorea.*

Etiology.—This form of chorea is rare. There is always a distinct history of heredity perhaps in one or two generations. It is not a disease of childhood, occurring usually after the age of 20. It may affect one or more in the same family, but may develop in a young child of a sufferer from this form.

Symptoms.—It is a disease of adult life, most cases occurring between 20 and 30 years of age. It is much like chorea minor, only the contractions are more severe, affecting chiefly the muscles of the face, peculiar grimaces being made, and of the arm and upper trunk. Sooner or later a mental condition de-

velops, which is much like dementia, following a short period of irritability and apathy.

Prognosis.—This is grave as to recovery. They may live years.

Treatment.—No treatment is of avail, the only recourse being confinement in an asylum or institution for the insane or feeble-minded. Symptomatic treatment is of course indicated.

HABIT CHOREA.

Synonym.—*Convulsive tic.*

Symptoms.—This form of chorea occurs in the delicate and cachetic children, chiefly in those children who can best be described as “spoiled.” The only manifestation may be a twitching of a muscle of the face, contraction of one or both eyelids, raising the eyebrow, drawing down of a corner of the mouth, pulling down or up of one shoulder, contraction of the sternocleidomastoid muscle, pulling the head down and out, supinating or pronating the forearms, protruding the tongue, twitching of the fingers, etc. A starting point of this may be a binding of one of the articles of clothing, the shoulder for instance, being raised to relieve it of pressure.

Diagnosis.—This is not always easily made from a mild chorea, except by the oft-repeated contractions of the same muscle or group of muscles, a purposeful movement.

Peterson describes a condition which he calls gyrospasms of the head, the head being rotated to the right or left many times per minute and often accompanied by nystagmus. In these cases he found a history of rickets or intestinal irritation.

Treatment.—The cause may be reflex and should be searched for, eye strain, phimosis, abnormalities of the ears and teeth, tight clothing, irritating underclothes, may be a cause, and if present, removed.

The diet should be controlled, sweets entirely eliminated, and regular meals insisted upon. No tea or coffee should be allowed. Removal from school until relieved. Proper rest and regular hours for sleep. Daily warm baths followed by a cool sponge if possible, and a vigorous rub. Suggestion is of value in some cases.

Medicinally, arsenic is of value, alone or best in combination with the bromides. General tonics are indicated very often.

ELECTRIC CHOREA.

This is a rare disease, so named because of the rapidity with which the movements follow one upon the other. They are violent as a rule. Dubini first described the condition in 1846.

The muscles of the neck and face are principally affected, but the arms and legs may also be involved. After varying duration of the active choreiform condition, the cases are described as developing atrophy and paralyses in the affected muscles or group of muscles, with perhaps complete paralysis. There may be pain and an elevation of temperature, the symptoms, collectively, and the termination suggesting a severe intoxication.

HYSTERIA.

This is a comparatively rare condition in childhood, but occasionally seen about puberty or following this period.

Etiology.—A “neurotic” family history is usually present, and it occurs in the “spoiled” child, more often in girls. Overcrowding at school is a potent factor, fright, emotional and sensational plays and books may influence it. There is usually a history of the child being delicate, perhaps having had the exanthemata and other illnesses, a variable appetite, with frequent digestive disturbances.

Symptoms.—These are usually divided into groups, according to the various systems involved, *sensory*, *motor*, *mental* or *psychic*.

Sensory Manifestations.—These symptoms may be manifested by *hyperesthesia* or *anesthesia*. The severity of the pain complained of is at once suggestive of the diagnosis. The slightest touch or even if the patient thinks it will be touched causes severe complaint. The location of the pain or point of tenderness does not correspond to the distribution of the nerve supplying the part. Anesthesia, if present, usually involves half the body, and of itself is a suggestive occurrence. Anesthesia of one area or region may also be present.

Photophobia may be present, or complete loss of sight in one

eye or loss of vision to part of the eye. The visceral form of hysteria may be mentioned here. The patient may refuse food entirely, or if taken may shortly be followed by contraction of the stomach and vomiting without nausea. There may be diarrhea in this form also. Tympanites is often present. Hysterical hiccough is encountered, and an inability to swallow. *Globus hystericus*, stricture of esophagus is not present. Nausea and vomiting may occur.

Motor Manifestations.—These are evidenced by a variety of convulsive movements which may affect the entire body or groups of muscles, one or both arms, or both legs, etc. Sensory symptoms may be present also. The following case is illustrative of this type of hysteria:

A 11-year-old girl was seen in consultation, who for three months had had severe "convulsions," occurring principally in the forenoon. The mother was thin, anemic, subject of organic heart disease, and very "nervous." When shown into the child's room the mother said, after we had talked for a few moments: "Have one of your spells now; you've had them this morning." Very shortly the child began with convulsive, up-and-down movements of arms and forearms, tightly clenched its hands together, moved up and down in bed, gave two or three long-drawn inspirations with its mouth tightly contracted and then relaxed, smiling shortly after. The knee reflexes were exaggerated.

Hiccough is a frequent form of muscular contraction. Hysterical aphonia is a common condition in hysteria, esophageal spasm being often associated.

Mental or Psychic.—Usually with either of the other group of symptoms there is a decided perverted mental condition, the child being extremely emotional. The phenomenon usually called hysteria is frequent, uncontrollable laughter followed by crying, or *vice versa*. Sachs terms an exaggeration of this condition *hysterical mania*, the child trying to do itself or others violence, being in a frenzy. Sympathy may precipitate such an attack.

Diagnosis.—If the motor symptoms are pronounced the trouble may have to be diagnosed from epilepsy. The child is in a condition of hysterioepilepsy. In this form of convulsive attack there is no aura, the onset is gradual, there may be

noises made throughout the attack, there is no impairment of vesical and rectal reflexes; the attacks last much longer, followed usually by a condition of trance; biting of the tongue is rare.

Treatment.—As in chorea, only the indication is even more pronounced, the first thing to be accomplished is to isolate the child from family and friends. This is far easier and better done by removing the child to an institution for the sick, and isolate it with a special nurse. The choice of a nurse is very essential. She should be firm, yet kind, and the child made to understand from the beginning that the nurse is in authority in the absence of the physician and absolutely in control. As soon as the acute symptoms are corrected the child should be placed under the care of a competent nurse or governess at home, and the same strict régime carried out there. What teaching is done, must be at home and not at a general or private school. Later private schools are of benefit, with limited number of pupils where individual attention can be given.

Careful written directions must be given in regard to the whole life and routine of the patient, diet, dress, habits, clothing, exercise and play.

Suggestive therapeutics in these cases are of the very greatest help, and should be carefully and conscientiously employed. Electricity may be classed under this head.

In some cases, in older children, especially where hysterical paralyses and joints are encountered, blisters and the actual cautery are of the most signal benefit. It may not be necessary to use them, their exhibition and explanation of method of procedure is usually all that is needed for a complete "cure." Cold douches to the back are also efficacious.

In the anorexia and vomiting, stomach washing and nasal feeding through tube, or gavage, usually brings prompt and favorable results.

EPILEPSY.

A functional disorder of the nervous system characterized by tonic and clonic convulsions at intervals, of the entire or a portion of the muscular system of the body, and attended by loss of consciousness.

Etiology.—There is no distinct etiology which is present in all cases. Heredity plays an important rôle in the etiology, a history of epilepsy, insanity or severe nervous disease in the family being present in a majority of cases. Consanguinity, alcoholism, syphilis, trauma are given as causes. Infantile cerebral hemorrhages are also a cause. Females are more often affected. The majority of cases occur between 5 and 15 years of age. Many reflex irritations are capable of precipitating the attacks, as phimosis, dental irritation, intestinal inflammations, visual defects, toxemias and intestinal parasites. Masturbation is also a cause. Frequent convulsions from reflex causes may eventuate in epilepsy.

Pathology.—But little which is definite is known of the pathology of this trouble, except in those cases due to cerebral hemorrhages. Degenerative changes have been found in the ganglion cells, with hyperplasia of neuroglia tissues. Dana gives the chief change as an induration or sclerosis.

Symptoms.—Two types are generally considered, *petit mal* and *grand mal*.

Petit Mal.—In this form of epilepsy there may be no convulsions but a temporary loss of consciousness which, because of the pallor present, may be diagnosed as a fainting attack.

The frequent occurrence of this phenomenon should arouse suspicion at once. The child may be at play and suddenly stop, and will sit, perhaps fall down; its face will become pale, eyes staring, pupils dilated and unconsciousness will follow for a brief or a much longer period. The respiration may be snoring in character. When consciousness returns the child will have a dazed expression and will not be able to recognize its surroundings. Usually there is no distinct aura, save, perhaps, a vague uneasiness felt by the patient, no preliminary cry and no involuntary passage of urine or feces.

Grand Mal.—In this form, which is usually meant when the term epilepsy is used, several distinct stages are present, (1) aura, (2) cry, (3) tonic convulsions, (4) clonic convulsions, (5) unconsciousness.

1. *Aura or Preliminary Symptoms.*—Premonitory symptoms

may be felt by the patient for a number of hours before the active convulsive stage sets in. This may be only a feeling of giddiness, numbness, tingling, vague abdominal sensations, excitement or depression, aural or auditory symptoms. These warnings, if present always in the same form, enable the patients to protect themselves from doing themselves bodily injury during the attack. The aura if present in the very young is not recognized as such by them.

2. *Initial Cry*.—The cry which precedes the convulsive attack is usually quite pronounced. It may be hoarse and guttural, or a sharp, shrill cry, followed at once by the period of spasm and unconsciousness.

3. *Tonic Spasm*.—This may begin as a twitching of the facial muscles, the eyes are open and turned up, pupils dilated, conjunctiva insensible and face pale. The body is rigid, the arms and legs slightly separated and extended, the fists clenched. This stage, lasting less than a minute, is followed closely by the stage of

4. *Clonic Convulsions*.—Rhythmic contractions of the muscles of the face, arms, legs and body begin, in the order named. There is stertorous snoring respiration, with accumulation of foamy saliva in the mouth, blood tinged, if the tongue is bitten, cyanosis of the face and lips. The sphincters may be relaxed with involuntary passage of urine and feces.

The active convulsions continue for two or three minutes, and gradually subside; cyanosis is followed by pallor, the pulse from being frequent and tense becomes feeble and slow, and the patient passes into the

5. *Stage of Unconsciousness or Coma*.—In this stage the patient usually goes into a profound sleep, lasting often several hours, from which he is with difficulty aroused, or the child may pass into a more or less natural sleep, lasting for a short time, and awakens in a dazed condition, not recognizing his surroundings. A feeling of depression is usually felt for a day or so following.

Diagnosis must be made from *hysteria*, *uremia*, *Jacksonian epilepsy*, or convulsions from reflex irritation:

EPILEPSY.	HYSTERIA.	UREMIA.
Aura	none	none
Sudden onset	excitement usually precedes	gradual
Loss of consciousness	none	yes
Pupils dilated, fixed; anesthesia conjunctiva, eyes rolled up	not altered	constricted without anesthesia
Tonic convulsion short duration	rigidity but no convulsions	more condition of stupor
Clonic convulsions various parts body	may be twitchings	none
Foam on lips, perhaps bloody from biting tongue.	none, do not bite tongue	none
Involuntary passage from bladder and bowel	usually none	none
Usually history of repeated attacks	as rule not as frequent	none
Prolonged stupor following convulsions, may occur in sleep	none rare	none possible

Urinary examination will reveal uremic nature of convulsions. In Jacksonian epilepsy the convulsions are unilateral, as a rule, perhaps affecting one leg or arm.

Prognosis.—Cases rarely recover. The duration, frequency and severity of attacks influence the prognosis greatly. The outcome is usually the development of dementia. The prognosis is worse when epilepsy develops in the young.

Treatment.—A careful investigation must be made to ascertain, if possible, any reflex cause, and that irritation removed. The various systems of the body should be reviewed and investigated carefully: The eye, for refraction difficulties, muscle irregularities; the nose and naso-pharynx, for deflected septum, tumors, polyps, catarrhal inflammation, adenoids, etc.; the mouth and gastrointestinal tract, for carious teeth, gastric insufficiency, dietetic errors, intestinal autointoxication or parasites, constipation or diarrhea; genitourinary, phimosis, vesical irritation, kidney defects; the skin, for any lesions, etc., etc.

The habits and life of the child should be inquired into carefully, the diet regulated, hours of rest and sleep, form of exercise and play, ventilation of bedroom, clothing, etc., must receive consideration. Coffee and tea should be prohibited.

If the convulsive attacks are very frequent and severe, these patients do best in a home for epileptics where they are constantly under observation.

In the control of the diet the method advised by Richet and Foulouse,¹ of withdrawal of salt from the food or at least a great diminution in its use, is worthy of trial, as excellent results have been reported from this simple procedure. It is reported that the convulsions are lessened in frequency and are much less severe.

A large number of drugs have been advocated in the treatment of epilepsy, the most generally used, and I might say also, abused, being the bromides. The bromides are of unquestioned value, but they also are capable of considerable harm if used indiscriminately. They do not cure the case, but do influence the attacks, both in frequency and severity. Ten grains of any of this group or a combination of the different salts every three hours during the day, to a maximum daily dose of 50 to 60 grains, will prove of benefit. The bromide of strontium is one of the most efficacious of the salts.

The fetid breath and bromide rash are evidences of saturation which indicates a discontinuance of the drug temporarily.

During bromide administration careful attention to the bowels is most essential. The giving of arsenic to limit the skin eruption has been suggested.

Confirmed epileptics do much better when segregated in a country home.

The decompression operation upon the brain offers some relief in certain cases.

DISORDERS OF SLEEP.

The new-born infant sleeps 20 to 22 hours in the 24, unless disturbed from some cause. When from three to four months old, it lies awake longer periods at a time during the day, but should sleep all night, waking for but one feeding from 9 p. m.

¹ Paris Academy of Science, November, 1889.

to 6 a. m. When six months old it should have no feeding at night, and sleep from 9 p. m. to 6 a. m.

The chief causes of disturbance of sleep lie in the respiratory tract and the gastrointestinal canal.

Catarrhal conditions of the nose, adenoids and enlarged tonsils which prevent the free passage of air into the lungs, cause great restlessness and loss of sleep. An elongated uvula may irritate the pharynx enough to cause an incessant coughing.

Too frequent feeding, too rapid nursing, too hot or too cold milk, prolonged breast feeding, will all cause discomfort, from indigestion, the child crying out in sleep and showing great restlessness.

It takes an almost incredibly short time for an infant to acquire bad habits of nursing, being held and rocked after feeding, etc., and a far greater length of time to correct these bad habits. Mothers and nurses are too often responsible for restless babies. The use of rubber napkins and failure to change the child through the night also cause restlessness. Imperfect ventilation, too little or too much cover may contribute to sleeplessness.

Older children need the same routine of hours for feeding and bed as the infants. Until the child is six years old it should be fed a very simple supper and be put to bed before 7 o'clock. Keeping children up late or showing them off to visitors at all hours of the evening or night cannot be too strongly condemned.

Telling exciting stories, threats of someone getting them and dark rooms strike terror in the hearts of most children, and may be the principal cause of night terrors (*pavor nocturnus*). During one of these attacks the child has a wide-eyed stare, does not recognize those around, may cry out, has hurried respirations, and is wakened to consciousness with difficulty. This condition may continue for some time, an hour or more, and the child fall into a deep sleep or waken crying, shortly to fall asleep again. As a rule it has no recollection of the occurrence on awakening in the morning.

If often repeated the cause of the disturbance must be located. If the last meal at night has been too large it must be regulated; no exciting stories or books or boisterous play should be allowed.

It should be carefully examined for any irritation, defect or abnormality which may possibly act as an exciting cause.

The administration of a 5 or 10 grain dose of the bromides is indicated in certain cases in which control cannot be had of the case by eliminating the cause.

ORGANIC NERVOUS DISEASES.

Diseases of the Peripheral Nerves.

There may be an inflammation of a group of the peripheral nerves, *neuritis*, or an involvement of the entire system of peripheral nerves, a *multiple neuritis*.

MULTIPLE NEURITIS.

Etiology.—An intoxication of the system with invasion of the nerve tissue with microorganisms, or the effect of the toxins on them, is the active cause, but exposure to wet and cold, trauma or pressure are predisposing causes most frequently met with. Diphtheria toxin is the most striking example of this. Prolonged administration of arsenic and lead poisoning are given as causes.

Pathology.—Inflammation and degeneration may be present in this condition, and occur in the same nerve at different points. There may be an inflammation of the sheath, the endoneurium may show an interstitial neuritis or the nerve tissue itself a parenchymatous neuritis. In the latter type the destruction is so great that the condition is like a degeneration, if not identical. If the degeneration is very extensive and severe there may be an entire destruction of the nerve tissue, leaving nothing but the sheath. Secondary degeneration is the form which usually takes place in the peripheral nerves. If the cells in the anterior horns of the cord degenerate there is degeneration also in the motor nerves. Regeneration may take place in degenerated nerves.

Symptoms.—The typical type of this form of neuritis is that caused by the toxin of diphtheria. It is rare in infants, but a number of cases have been reported in children from five years up. It is much more rarely seen since the general use of diphtheria antitoxin.

The onset is sudden, with frequently an initial chill, perhaps convulsions; there are pains and sensitiveness in the extremities, chiefly the lower; fever may run high, 103° to 104° F. The child is extremely weak, and unable to stand. The pains continue, the muscles begin to atrophy and paralysis sets in. The reflexes are diminished or lost entirely. Hyperesthesia followed by anesthesia may occur, the latter being due both to pain and heat. Some of the muscles of the eye and throat may be paralyzed. Regurgitation of food is present when the latter occurs. There is wrist drop and foot drop in the general form. No reaction takes place to the rapidly interrupted current, and the reaction to the galvanic current slow.

Prognosis.—Regeneration of the nerve tissues generally takes place and recovery occurs, in from one to three months.

The prognosis depends somewhat upon the extent of the loss of electrical reactions. If the reaction of degeneration is complete the prognosis is more grave, as far as entire restoration of function is concerned.

Treatment.—Complete rest in bed is the first indication. Pain being one of the first and chief symptoms it is the first to demand attention, if not relieved by the application of heat it must be relieved by an anodyne. Heroin, codeine or one of the coal-tar products can be used, the latter, however, with caution. Pyramidon is perhaps the safest. Moist heat is a help in obtaining comfort. Calomel as an initial remedy is indicated. Strychnia injected into the affected muscle has been advised. Among the drugs suggested are the following: Fl. ext. ergot, ʒss to ʒi; sodii salicylatis, gr. x. q 3 h.

Electricity is of great service, the galvanic current being the form to use at first, but only after the acute symptoms have subsided. After a month or six weeks, with improvement the faradic current is indicated in connection with massage.

FACIAL PALSY.

Synonym.—*Bell's Palsy.*

In this form of neuritis the seventh nerve is involved.

Etiology.—Infection, exposure to cold, rheumatism, middle-ear inflammation, mastoid disease or following an operation

for it, pressure by forceps blades in instrumental delivery, prolonged second stage in deformed pelvis are given as causes. If central, the process may be due to a meningitis, or brain tumors.

Symptoms.—The first symptom may be pain and tenderness under the lobe of the ear at the point of exit of the nerve, followed very soon by paralysis of motion of the muscles of one side of the face.

The characteristic signs of Bell's palsy are the inability to close the eye on the affected side, the eye rotating upward when attempting to do so, inability to pucker the mouth as if to whistle, and a deflection of the tongue from the median line, toward the normal side. Older children may have difficulty in masticating their food. If the acute symptoms do not last very long the prospects for entire recovery are good. Atrophy of the muscles may follow.

Diagnosis is chiefly to be made from lesions of the brain, which is usually easy, as paralyzes of the upper extremities, one or both, are also apt to be present.

Prognosis.—The majority of cases recover, practically with entire restoration of function of the muscles. The duration is from six weeks to five months. Continued reaction of degeneration renders the prognosis less good.

Treatment.—In all cases the use of cathartics is indicated, with rest in bed or on the bed while the pain under the ear lasts. A small fly blister, one-half inch square, placed at the point of exit of the nerve is of benefit.

After the acute symptoms have subsided the weak galvanic current is used very gently, and just strong enough to contract the muscles.

If there is much contracture of the mouth, the strain on the cheek can be relieved by bending soft wire with a small hook at the end for the mouth, the other end hooking over the ear.

The administration of iron, salicylate of soda and arsenic may give good results.

OBSTETRICAL PARALYSIS (Erb's).

These palsies take their name from the fact that they appear after manipulations during labor. It is a result of injury to

the brachial plexus of nerves and occurs when the head is pulled sharply to one side, or traction is made with the fingers in the axilla, in an effort to deliver the shoulders. It occurs about once in 2000 labors, and a small percentage of the cases are bilateral.

The paralysis usually manifests itself about the third or fourth day after birth. The infraspinatus muscle is most involved. The child may move its forearm and hand, but makes no effort to move the arm from the body. At first, however, the whole arm is limp and motionless.

If there is no improvement the deformity noticed is a slight inclination forward of the affected shoulder, an atrophy of the muscles of the upper arm and shoulder, and tendency to an inward and forward rotation of the arm so the thumb points rather backward instead of forward. The paralysis is flaccid in type, and there is no tendency at all to a spastic condition.

There is a characteristic electric reaction varying from a loss to the faradic current to a complete reaction of degeneration. If there is no faradic response but the response to galvanism retained, even if but feebly, recovery may take place; if response to both currents is gone the recovery, if it takes place at all, will be greatly retarded.

Treatment.—Nothing is indicated during the first two or three weeks. At the end of this time gentle rubbing, not deep massage, should be begun, with gradually increasing passive motion. At the end of six to eight weeks, a very weak electric current is applied, using the current with which a reaction can be obtained. This is applied once a day or every other day, at first five minutes, then ten minutes at a time.

DISEASES OF THE SPINAL CORD.

Acute Poliomyelitis.

Synonyms.—*Infantile paralysis, Infantile spinal paralysis.*

History.¹—This form of paralysis was first described by Heine in 1840, his writings being more upon its end results than of the disease producing the paralysis.

¹ Much in this section is obtained from Monograph No. 4—June 24 of Rockefeller Institute for Medical Research: "A Clinical Study of Acute Poliomyelitis," by Peabody, Draper and Dochez.

Numerous epidemics were studied and many contributions to the literature upon it were made. In 1905 Wickman described the pathology of the disease and called attention to its epidemiology.

Etiology.—Experimental production of the disease in monkeys was accomplished by several laboratory workers in different countries, in 1909, and their results published almost simultaneously. As a result of this work a bacterial cause has been ruled out and undoubted evidence developed that the infective agent belongs to the so-called filterable virus group. This virus is resistant to many destructive agents, but is readily destroyed by a 2 per cent solution of hydrogen peroxide, by menthol and corrosive sublimate.

Epidemiology.—Wickman first called attention to the abortive and meningitic forms of the disease, and it has focused attention on a disease which is unique, in that its epidemic nature is not caused by a parasite. It follows lines of human contact and travel, and the so-called healthy “carrier” is to be reckoned with in its dissemination. There is every evidence to support the theory that the port of entry into the system is the naso-pharynx, the tonsils and the upper respiratory tract. It has been shown that there is a direct lymphatic connection between the naso-pharyngeal lymphatics and the subarachnoid space.

The virus can be carried on articles of clothing, bedding, domestic pets, the fly, and by dust.

The common belief among the laity that trauma has a part in the etiology can positively be ruled out.

It occurs more frequently during the first three years of life, but adults are not immune. It may occur in more than one member of a family, boys are probably more often affected.

Late investigators¹ claim to have transmitted the disease to monkeys. They conclude that the virus must be of protozoon nature.

Epidemics of infantile paralysis are most frequent in the late summer and early autumnal months. Starr² has collated 44 epidemics of infantile paralysis. Individual cases may and often

¹ Landsteiner and Popper: *Ztschr. f. Immunität u. Exp. Therap.*, 1909, ii, 377.

² *Journal American Medical Association*, vol. ii, no. 2.

develop during an attack of acute gastrointestinal infection. It may also occur as a sequel to one of the exanthemata, particularly scarlatina, this being due to the lowered resistance of the child and the increased susceptibility to the virus of this disease, though it occurs fully as frequently in the previously perfectly healthy.

Pathology.—In the recent investigations it has been shown that poliomyelitis is a general infection rather definite and constant changes being found in other organs than the nervous system.

The meninges are edematous and injected. The brain and cord are edematous also. The cellular exudate, hemorrhage and edema are characteristic of the change occurring as a result of the action of this virus.

Any section of the cord may be involved, the lumbar region perhaps most frequently, the cervical next in frequency. The process occurs chiefly in the anterior horns of gray matter, and it may vary from a simple congestion to an inflammation. This part of the cord has the most active blood supply, and it has been pointed out by different observers that the primary changes are in the blood vessels, and the degeneration which occurs in the ganglion cells are entirely secondary. As a result of this degeneration, the ganglion cells may disappear entirely, and the process may extend to the entire gray matter, which is often swollen and projects above the white matter. These changes occurring in the posterior root ganglia and the changes in the sensory ganglia possibly explain the pain present in the acute stage of the disease.

The lymphoid tissue of the body, especially Peyer's patches and mesenteric glands show acute swelling. The superficial glands of the body, the tonsils, thymus gland and spleen are regularly enlarged. Cloudy swelling of other organs is described as present. The affected muscles show a characteristic change, many muscle fibers disappear entirely and the others are shrunk, the whole limb being atrophied, even the bone being smaller than that of the unaffected side.

Symptoms.—The following clinical types have been described by Wickman: (1) spinal poliomyelitic form, (2) Landry's

paralysis type, (3) bulbar or pontine form, (4) the encephalitic form, (5) the ataxic form, (6) the neuritic form, (7) the meningeal form, (8) the abortive type. Peabody, Draper and Dochez advocate the classification into three main groups: (1) those cases in which the upper motor neurone is primarily affected, the cerebral group; (2) the larger group of cases in which the lower motor neurone is involved, the bulbospinal group; and (3) the abortive cases, which do not become paralyzed. It is more often seen in the robust, and if not associated with other diseases is like an infectious disease in its onset. The period of incubation is very variable, but from observation of cases occurring in the same family it is believed to be from one to four days. There are nearly always some prodromata; the child may awaken in the night, after a period of restlessness or perhaps, there has been listlessness during the previous two or three days. There may be anorexia, nausea or vomiting and fever to 102° F. or 104° F. and in those so inclined, even convulsions. A chill is comparatively rare. Sweating is sometimes present. Pain is present in the back of the head and in the affected muscles. The acute symptoms last two or three days, during which time muscular weakness is present, when the paralysis is noted. Fever may continue for a week. Diarrhea is seen often. The skin is very active. In contrast to the cases with severe prodromata there are cases which show but little indisposition, the paralysis being the first symptom noted, and the paralysis may be as severe in these cases as in the others. Müller claims there is a leucopenia present, but later authorities do not think it is a sign to be relied upon. There is a moderate increase in the pressure of the spinal fluid when lumbar puncture is done, and increase in the number of cells per cubic millimeter; the type of the cells may be either mononuclear or polynuclear. The absence of the bacteria present in the spinal fluid in other meningitic infections make this method of diagnosis more important.

In the *usual form* as described by Peabody, Draper and Dochez, the paralysis appears on the first or second day of the disease. The child is drowsy and lies on its back with legs slightly flexed and everted. It can be roused by the gentlest

touch or manipulation of an extremity. If it is the paralyzed limb which is moved the child will attempt to free it from the examiner's hand by a twisting motion of the body and shoulders, which is accompanied by a fretful look and whine. When there is more meningeal irritation the position assumed is usually upon the side with more or less retraction and rigidity of the neck or opisthotonos. Crying or fretfulness may begin as soon as the bed is approached. Ocular paralyses may be present, sometimes photophobia. The throat is usually congested and tonsils swollen, tongue coated, enlargement of superficial lymph nodes. Most rales may be found in the chest without coincident temperature.

The paralysis makes its appearance rather suddenly as a rule. In infants it may be recognized only after prolonged watching at the bedside.

The reflexes, both superficial and deep, vary considerably. Sweating, both general and localized, may be present. Retention of urine may be seen. Constipation is the rule.

Pain is a constant feature and a symptom which is not generally attributed to this form of paralysis. Three types are described: pain on manipulation; spontaneous pain; and tenderness on pressure over the muscles and nerve trunks. As stated a few cases may be seen in which the illness apparently began with the paralysis. Their appearance and symptoms are much as the type just described.

In the so-called meningitic or cerebral form there is a marked disturbance of the sensorium. Profound stupor follows the drowsiness of the ordinary form, and the picture is much that of a patient with tubercular meningitis, and it may require a tuberculin test to differentiate. After a varying length of time, the stupor clears up, the child passing through a period of fretfulness and irritability.

Paralyses.—The paralysis is of the flaccid type, of lower neurone destruction, without contractures, associated very soon with atrophy, the electric reactions are altered, the sensation is not greatly impaired though it may be tender and the reflexes diminished or lost in the affected limb. The affected part is cold and often cyanosed.

The paralysis at first may involve the entire extremity, and as the inflammation or congestion subsides restoration of function in all but a single muscle or group of muscles takes place. This is a characteristic symptom of infantile paralysis. This improvement usually occurs within the first three months.

The atrophy is progressive until the difference in the two sides is quite marked. The chief cause of deformities is the strength of the opposing muscles.

The paralyses are not symmetrical in their distribution, as one leg and one arm may be affected or the perineal muscles of one side and the face.

The electrical reaction is that of complete degeneration, complete loss of faradic and galvanic response in the nerves, and delayed galvanic response in the muscles.

Diagnosis.—In many cases the diagnosis is not made until the development of the paralysis. The acute condition may be mistaken for any of the acute intoxications according to the predominance of the symptoms. The chief condition which may be confused with infantile paralysis is cerebrospinal meningitis, but the convulsions of infantile paralysis occur only at the onset, and none of the other meningeal symptoms are present.

In the acute cerebral palsies the chief diagnostic symptom is the spastic nature of the palsy, without atrophy; its hemiplegic nature; the normal electric reaction, with not infrequent involvement of the mind. The reflexes in the cerebral type are exaggerated also.

In neuritis the pain is a prominent symptom, which is usually less in poliomyelitis, but in other respects the symptoms are much the same, viz., paralysis, atrophy and electrical phenomena.

Prognosis.—The mortality in sporadic cases is small, and in epidemics from 6 to 10 per cent. In Wickman's series of 868 cases the mortality was 16.7 per cent. Death occurs most often on the fourth day of the paralysis, though they are not out of danger until after the eighth day from the beginning of the muscular weakness. There is no way of giving an accurate prognosis in the beginning of an attack, as often a very hopeless looking case will show regeneration of a number of muscles

which at first showed complete paralysis. The family should, however, be put in complete possession of facts, and the possible outcome, emphasizing the favorable symptoms always, but there is absolutely no way of anticipating the paralysis. A number of cases have been reported showing complete recovery.

Treatment.—Steps must be taken at once the diagnosis is made to establish a strict quarantine. In view of the fact that the virus in experimental work on monkeys has been found rarely to persist after three weeks, it is safe to isolate affected children for four weeks from the beginning of the attack. In the acute stage dry cups along the spine may be beneficial. Hydrotherapy is of great benefit. In this stage an anodyne is needed for the pain unless it is controlled by the application of a splint or bandage. The application of an ice bag to the spine is of great benefit and comfort. Absolute rest in bed is the chief indication.

Attention should be given to the bowels, an initial calomel purge being of benefit. The diet should be bland and easily digested, and a minimum of sweets given.

Careful nursing by a trained and competent nurse should be insisted upon.

With the first evidence of contracture of opposing muscles enough to cause deformity, a brace should be so applied as to overcome this, or the leg held in place by sand bags. If the contraction is very great before the brace is applied, a tenotomy of the opposing muscle should be performed, followed by application of a plaster of dressing with the part being slightly over-corrected.

Massage is of great service after the acute symptoms have begun to subside, to exercise the flaccid muscles. Muscle training is of great assistance. Electricity is to be used for this purpose also. In the early stages galvanism should be used on the nerve trunks and faradism on the muscles so long as their irritability for contraction is maintained. When irritability of contraction to the faradic is lost galvanism should be used. It should not be applied oftener than once a day, 10 or 15 minutes at a time, and continued for several months, and should be used only by those expert in its application.

Much has been accomplished in the last few years in the treatment of marked deformities in the transplantation of tendons, for the technic of which the reader is referred to any of the late works on surgery.

Not much improvement can be looked for for several weeks, when an evidence of regeneration will show by return of function in some muscles. It is advised to give hexamethylenamine, gr. v, every four hours, to child of eight years (Cushing). Salicylate of sodium or strontium can be used to advantage.

ACUTE MYELITIS.

An inflammation of the entire substance of the cord, in a transverse section, or over an extensive area.

Etiology.—This is essentially an acute infection, occurring independently or as a sequel to one of the acute infectious diseases or exanthemata. It may also result from an extension downward of a primary meningeal lesion. Congenital syphilis and Pott's disease are among the active causes. Trauma, resulting in pressure or hemorrhage into the cord may be the cause. The causes given in the adult form, as alcohol, lead, mercury, etc., can practically be eliminated in children.

Pathology.—There is no regularity in the extent of involvement or limitation of the segments involved, as two or more portions of the cord may be affected with normal tissue between. The dorsal portion has been found most often involved. The chief, and perhaps primary, changes are in the blood vessels, the blood supply is interfered with, there are minute hemorrhages in the gray matter and softening occurs. The meninges are congested and swollen. The white and gray matter are not distinct. The cord substance is destroyed and is soft and creamy in consistence. The process described extends to the nerve roots also.

Symptoms.—These vary greatly, and because of the variety in symptoms the cases have been grouped into acute, subacute and chronic forms.

In the *acute form* the onset is sudden, and if of septic origin it begins with a chill and fever, usually above 102° F. There is pain in the back, varying with the site of the lesion. Tenderness over the affected area is also present. If there is an entire

transverse inflammation the function of all muscles below this level are interfered with, including the sphincters. If the upper part of the cord is affected the arms are also paralyzed. Complete anesthesia is present extending to a level of the lesion. All sensations, thermal, muscular pain and touch, are absent, and the patient does not feel as if the extremities were a part of him.

If the lesion is in the cervical portion of the cord the paralysis of the arms will be flaccid and of the lower extremities spastic in character. If the lower portion of the cord is affected the paralysis is of the lower extremities and is of the flaccid type, with loss of reflexes but without involvement of the arms. Trophic lesions will often develop in these cases, with development of bed sores. If these are large and absorption from them possible, the temperature will be influenced.

In male children priapism may be present in lumbar involvement, and in all cases disturbances of bladder and rectum take place. Involuntary passages of urine and feces frequently occur, though retention of urine is perhaps more frequently followed by cystitis.

Diagnosis.—The clinical picture presented is fairly typical of this form of lesion. In *hemorrhage* into the cord the onset of the trouble is more sudden, without fever and without loss of reflexes, atrophy or reaction of degeneration. In hemorrhage the pain is not so great, if present at all.

In *multiple neuritis*, if all of the extremities are involved, the paralysis is the same, while in *myelitis* the paralysis may be flaccid in the upper and spastic in the lower extremities.

Prognosis.—A guarded prognosis should always be given. The more extensive the involvement and acute the symptoms the graver the prognosis. The early development of complications, as bed sores, cystitis, etc., make the prognosis graver.

In the subacute variety, regeneration may take place to some extent in the cord, and restoration of function to a certain extent be possible. In syphilitic cases good results are obtained from specific treatment.

The younger the child the graver the prognosis.

Treatment.—The child will usually have been put to bed

when first seen. If a young child, positive orders must be given that it be not taken from the bed and held or rocked under any circumstances.

Local application of cold by a long ice bag is of service and should be applied intermittently. The tendency to trophic disorders should be remembered, and the long-continued application not allowed. The bladder and bowels must be closely watched. Extra precautions must be taken if catheterization is needed. The position of the child must be changed often and the skin of the dependent parts closely guarded against bed sores. Most careful attention must be given the bed sore if the skin breaks down. Ichthyol ointment, 3 or 5 per cent, or balsam of Peru (M. xx) and castor oil (ȝi) are good dressings in these cases. A water bed or air mattress may prevent the development of bed sores.

If improvement is shown the child must be carefully watched to keep it from using the affected parts. Judicious massage and rubbing should be used for exercise.

In the syphilitic cases the early administration of appropriate remedies is indicated.

Tonic treatment, especially out-of-door air, is indicated. If contractures develop, tenotomy and the proper orthopedic measures used to prevent and correct them.

POTT'S DISEASE.

No attempt is made to describe the condition of Pott's disease from the standpoint of the orthopedic surgeon, but only as relates to the changes it produces in the spinal cord. It is a fairly common condition in childhood, and is due to a tubercular osteitis.

Owing to softening of the bony and intervertebral cartilage an angulation takes place in the spinal column, its lumen is narrowed and pressure is made on the cord. Yet it is surprising how great the deformity may be without any pressure symptoms presenting. The inflammatory condition from the bone extends to the meninges and thence to the cord, or pressure symptoms may be present from the meningeal involvement alone.

The cord may be softened and degeneration of the cord is

found above and below the point of pressure. Much the same condition is present as in myelitis.



Fig 85.—X ray of Pott's disease involving first lumbar and last dorsal vertebrae.

Symptoms.—The development of this condition is very slow as a rule. Spastic paralysis is an early symptom and may be the first noted. Sensitiveness and pain are present when pres-

sure is made, due to involvement of the nerve roots. Disturbed sensation may also be present.

Diagnosis.—This is to be made principally from myelitis. A careful examination of the spine for deformity or rigidity should always be made in cases of suspected spinal cord lesion. In Pott's disease there is pain on pressure over the involved vertebra. In those cases in which the paralysis precedes the deformity the diagnosis may be difficult.

Prognosis.—If the paralysis is entirely due to the pressure, with but little inflammation present in the cord, the process may be stopped by proper orthopedic measures, taken to relieve the deformity and pressure, by properly fitting appliances. However, the case is apt to be progressive, and the outlook for recovery very grave.

Treatment.—The first positive indication is to relieve the pressure by prompt orthopedic measures. Perhaps rest in bed, entirely recumbent, may influence the condition, or in other cases plaster of Paris jackets are indicated.

Fresh air, tonics, good food and hygiene are the chief indications other than the surgical ones.

TUMORS OF THE SPINAL CORD AND ITS COVERINGS.

These growths are very rare in childhood. Syphilis and tuberculosis cause the majority. Malignancy may be the cause. Cysts and gliomata are also given as causes, the former due to hemorrhage.

Symptoms.—The onset is very gradual, the symptoms varying according to location of the tumor. If the meninges are principally involved there is pressure on the posterior roots and pain later after involvement of the meninges and roots takes place. Not infrequently only half of cord may be involved. The cervical and dorsal regions are perhaps most often affected. There is flaccid paralysis of one or both arms when located high up, and of the legs when lower in the cord. Atrophy soon develops in each.

Diagnosis.—In *Pott's disease* the deformity is usually present and the course of the disease is longer. In *myelitis* the course

is much more rapid, pain is not so prominent and paralysis sooner.

In *neuritis* paralysis is present earlier and the rectum and bladder not involved.

Prognosis.—This is unfavorable, as surgery offers but little hope. In syphilitic tumors some good may be accomplished by proper treatment.

Treatment.—Except in syphilitic tumors, drugs are of no avail. The iodides and mercury should be tried in every case, but their efficacy is doubtful. Operation for removal of the tumor should be performed if all other remedies fail, though it is an operation with but little hope of relief, and most difficult to perform.

SYPHILIS OF SPINAL CORD.

The infant, the subject of hereditary syphilis, is apt to develop this condition more often than if it is acquired.

Pathology.—An involvement of the arteries is the most frequent lesion, an endarteritis or arteritis causing softening of the cord substance, as in myelitis. A meningitis is present, also gummata in the cord and brain.

Symptoms.—These are not like those present in conditions just described. The onset is gradual; the paralyzes follow a period of weakness of the muscles and inability to walk, and are more apt to be of the spastic variety. Pain or anesthesia, or both, are present, varying according to the involvement of the roots. Reflexes are usually increased, sphincteric reflexes may be interfered with.

Usually there is an irregular distribution of the disease over the greater part of the cord. The dorsal enlargement is most often and severely affected. The process spreads irregularly to other portions of the cord, evidenced by irregular areas of loss of sensation here and there on trunk and extremities.

Diagnosis.—This is chiefly from *myelitis*. The history of syphilis or its manifestations in other parts of the body is an aid in diagnosis. In myelitis a whole cross-section of the cord is involved, and symptoms are the same on both sides below the level of the lesion; in syphilis the invasion of the cross-

section of the cord is slow. Erb's statement that in syphilis there may be complete paralysis with but slight anesthesia and slight rigidity should also be remembered.

In infantile *spastic paraplegia* the early appearance of the trouble and the absence of particular sensory symptoms makes the diagnosis clear.

In *infantile paralysis* there is but little pain, and the irregular distribution of the paralysis, as the right arm and left leg, with the absence of sensory symptoms rules out syphilis.

Treatment.—Mercurials and iodides are positively indicated, and the earlier they are given the better the prognosis. In the child the inunction of mercury is the best method of administration, with gradually increasing doses of the iodide of potash. Fifty per cent ung. hydrargyri, with vaseline or lanolin, can be used, rubbing a piece the size of a small hazel nut into the flexures and groin once daily.

With the development of acute coryza the iodides should be discontinued temporarily, and when resumed, begin with the minimum dose, and increase as before.

DISSEMINATED SCLEROSIS.

Synonyms.—*Multiple cerebrospinal and insular sclerosis.*

According to Foltzke this disease may be manifest at birth or develop during the first year, but the larger number of cases are seen during the second decade.

Etiology.—The infectious diseases are considered the most frequent causes. Among the other causes may be mentioned trauma, heredity and metallic poisoning (Oppenheim).

Pathology.—There are irregular patches of sclerosis at various points in the central nervous system, brain, pons, medulla and cord. The growth is of fibrous tissue, an increase in neuroglia tissue. Some changes take place in the blood vessels.

Symptoms.—Following a brief period of weakness of the lower extremities, and sometimes the upper, there develops an intention tremor which is very noticeable. It is only present when the patient wills to make a movement, and in an effort to accomplish it the tremor takes place. The tremor becomes so marked that the patient cannot feed himself or drink from a

glass held in one or both hands. Next develops a difficulty in speech, which has been designated *scanning speech*. He speaks very slowly and deliberately.

The eye symptoms are fairly characteristic. Nystagmus develops early, especially when looking from one side to the other. The visual field is narrower. The mind becomes affected rather early. Hysterical attacks are common, memory is bad.

The lower extremities develop a spastic paralysis, which greatly interferes with walking.

There are no distinct or typical electrical reactions, the sphincters are not involved and, as a rule, atrophy of muscles does not take place unless there is sclerosis of the anterior horns, which occurs less frequently.

Diagnosis.—In *myelitis*, sphincter relaxation and sensory phenomena are prominent symptoms.

The association of the usual symptoms, intention tremor, scanning speech, mental symptoms and spastic paralysis are sufficient to make the diagnosis.

Prognosis.—The condition is incurable and it is essentially a chronic disease.

Treatment.—The patient should have a protracted rest in bed as soon as the diagnosis is made, especially if there is a decided intention tremor. General tonic treatment is of benefit, including hydrotherapy, electricity and massage, all intelligently applied.

HEREDITARY ATAXIA.

Synonyms.—*Friedreich's disease; family disease of the cord.*

Etiology.—This is essentially a disease of early life, developing in the majority of cases before the tenth year. It is believed by some to be primarily due to an arrest of development of the cord. It may occur in several generations, and often several are affected in the same family, and usually of the same sex.

Pathology.—The process is principally located in the posterior and lateral columns, though the entire cord is smaller than normal. The process is principally a sclerosis, either located entirely in the column of Goll or the columns of Burdach

or both, and generally the entire length of the cord is affected.

Symptoms.—Generally the first symptom, if it is not present at birth, is a peculiar gait, the child being unsteady and awkward on its feet. It balances itself with feet separated, and the gait is much as it is in locomotor ataxia. Following this manifestation in the lower extremities, a spastic condition develops in them, and a loss of power in the upper extremities and a jerky movement of them when an attempt is made to grasp or pick up an object. Nystagmus may be present at this time also ptosis and strabismus may be present. The child talks thickly and later cannot be understood. Sensation is rarely interfered with. Deep reflexes are not present as a rule, the patellar reflexes cannot always be elicited.

Deformities develop after the spastic stage sets in, particularly in the feet, the great toes being hyperextended, the other toes to a lesser degree.

Mentality is much interfered with as the disease progresses.

Diagnosis.—*Tabes* resembles this form of ataxia, but it is practically never seen in children. In *multiple sclerosis*, the intention tremor and marked spastic gait are diagnostic signs.

Prognosis.—These cases grow progressively worse until they are completely helpless, but life is often prolonged for years.

Treatment.—Nothing can be done to influence the course of the disease. The patient can be made comfortable by attention to hygiene, diet, etc., correction of deformities by section of contracted tendons, etc., and medicinal treatment given as symptoms arise.

HEREDITARY SPASTIC PARALYSIS.

A condition occurring as a family characteristic, in which there is a spastic paralysis chiefly affecting the lower extremities, more rarely the upper.

Cases present different symptoms according to the chief location of the pathological lesion, cerebral or spinal, or a combination of both.

In the *spinal type* the chief symptoms are spastic paraplegia, with contractures and increased reflexes, and the pathologic proc-

ess is located in the pyramidal tracts of the lateral columns. In this type there is no evidence of cerebral involvement.

In the *cerebral type* the first symptom to call attention to abnormality is an arrested cerebral development. If the disease develops early the child will not show the normal intellection of its age, or if older will soon develop idiocy. Blindness is often present. They are classed under the term *amaurotic family idiocy*. If of the *cerebrospinal* type the spastic condition above referred to develops in addition to the idiocy.

Diagnosis.—The hereditary nature of the disease is characteristic. In congenital paralysis there is a history of convulsions, and usually of a difficult labor, and no hereditary history.

Prognosis.—These cases may live for years, but the outlook for recovery of mind is hopeless.

Treatment is entirely of no avail, and is symptomatic.

PROGRESSIVE MUSCULAR DYSTROPHY.

Synonyms.—*Primary myopathy, Idopathic muscular atrophy.*

A condition in which there is a progressive muscular weakness of a certain group of muscles; associated with atrophy.

Etiology.—This is a family disease; several members being often affected, the transmission being through the mother.

Pathology.—The pathology is chiefly in the muscles, the fibers being atrophied, the sheath being often filled with fat. The spinal cord and nerves are normal. In the pseudohypertrophic form there is also an increase in fat between the fibers and an increase in the connective tissue.

Symptoms.—Three types are generally described, *pseudohypertrophy* of the muscles; juvenile type (Erb's); and *Landouzy-Déjerine's* type, the latter the facioscapulo-humeral variety.

In the *Landouzy-Déjerine's type* the principal groups of muscles involved are those of the face and shoulder girdle. The first muscle to atrophy is the orbicularis oris, followed by the other facial muscles and of the shoulder girdle.

Sachs¹ has given the following tabular description of the three:

¹ Sachs: Nervous Diseases of Children.

TYPES OF PRIMARY DYSTROPHIES.

	MUSCULAR PSEUDO- HYPERTROPHY	JUVENILE FORM OF PROGRESSIVE MUSCULAR ATRO- PHY (ERB'S TYPE)	TYPE LANDOUZY- DEJERINE
Part first affected	Legs (calves).	Shoulder girdle	Face and shoul- der girdle.
Distribution of hypertro- phy	Calves, rarely thighs.	Muscles around shoulder gir- dle and pel- vic girdle.	None.
Distribution of atrophy..	Thighs, deep muscles of back, shoul- der, and scap- ular muscles. Calves during later period; at that time also general atrophy.	Thighs, deep muscles of back, upper arm. Hyper- trophied parts may become atro- phic in later stage.	Face muscles, including lips and orbicu- laris palpe- brarum ; shoulder and scapular muscles.
Parts remaining normal..	Face, forearm, and hand, ex- cept in last stages.	Face, forearm, hand and leg muscles ex- cept in last stages.	Forearm, hand and legs, and deep muscles of back.

Erb's type begins in late childhood, before puberty, and involves the muscles of the shoulder girdle, including the del-
toid, the pelvic girdle and the back. Because of atrophy of the
muscles of the back, the child stands with a decided arch in
the back and lordosis, the shoulder blades are thrown backward
and the shoulders forward.

The legs are affected late in the disease.

In the *pseudohypertrophic* form the principal change is in
the calf of the legs and thighs. As the name implies, there is
a decided increase in the size of the legs and thighs, with a coin-
cident loss in power. The gait is a peculiar waddling one.
When sitting on the floor characteristic positions are assumed

in attempting to get upon his feet. With the assistance of his hands he climbs up on himself, gradually assuming the erect posture, with the lordosis present, standing with feet wide apart. When prostrate upon the floor he cannot rise. When the



Fig. 86.

Fig. 87.

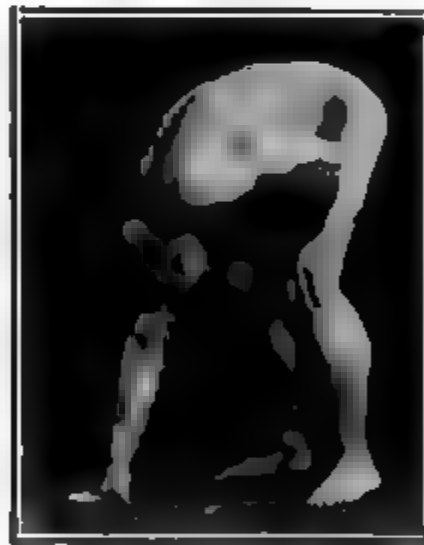


Fig. 88.

Typical attitudes assumed by patient with pseudohypertrophic muscular paralysis.
(Courtesy Dr. Frank L. Christian, Elmira, N. Y.)

muscles of the arm and forearm are involved the same hypertrophy takes place here. Late in the disease the face takes on a peculiar lack of expression and intelligence.

Prognosis.—As to cure, this is grave. Arrest of the disease has been reported.

Treatment.—The general tonic treatment is indicated, with massage, electricity, hydrotherapy, attention to diet, etc.

DISEASES OF THE MENINGES AND BRAIN.**Meningitis.**

Several varieties of meningitis are named, *simple acute meningitis*; *tubercular meningitis*; *cerebrospinal meningitis*, with numerous subdivisions according to the part involved and the etiology.

Simple Acute Meningitis.

Etiology.—This form of trouble is essentially due to an infection, either during the infectious diseases, typhoid fever, pneumonia, the exanthemata, influenza, nephritis, etc., to trauma or to emboli of a septic nature and middle-ear trouble. The pneumococcus, streptococcus, and staphylococcus, typhoid and influenza bacilli are the organisms most frequently found.

Pathology.—The chief inflammatory changes are in the pia mater, followed by a change in the dura. The greatest involvement is at the base, principally the posterior portion. The serous membrane is red, thickened, dull and rough, covered with fibrin; this stage is followed by one of effusion, at the base or in the ventricles. This may be serum, or according to the infecting organism, purulent in character.

Symptoms.—A short period of indisposition may be present, the nature of which is not even suspected with gradual development of the symptoms, or it may begin with a convulsion, high fever and rapid pulse. There may also be severe headache, vomiting of the projectile type, sleeplessness, restlessness, photophobia and rigidity of the neck. The convulsions may be repeated. The temperature is usually high, 104° F., but may average 101° F. or 102° F. The pulse and respiration are apt to be irregular. Coma or stupor may be prominent. Opisthotonos may occur shortly before death or in one of the convulsions.



Fig. 89.—Typical muscular enlargement. Pseudohypertrophic muscular paralysis.

The duration is usually from ten days to three weeks, or even much longer.

Prognosis.—This is grave. Recovery sometimes occurs, but the diagnosis is often questioned closely before admitting the correctness of it.

Diagnosis.—Differential diagnosis from tubercular and epidemic cerebrospinal meningitis considered later. In the presence of convulsions as the primary symptom, the diagnosis should not be made until the various intoxications, as intestinal, etc., are eliminated, as they can be usually in a few days, at the most. Lumbar puncture will aid the diagnosis by examination of the fluid removed.

Treatment.—Absolute quiet, in bed, in a darkened room. Purgation, preferably by calomel followed by a saline, is possible, and the intermittent application of an ice bag to the head, at the base, sides and top, is beneficial. Hydrotherapy for the temperature and the administration of bromide and chloral for the control of the convulsions and restlessness. Iodides during convalescence is helpful.

Liquid, perhaps predigested, nourishment and attention to the kidneys is important.

EPIDEMIC CEREBROSPINAL MENINGITIS.

Synonym.—*Spotted fever.*

As the name implies, this form of meningitis occurs epidemically, and is due to the specific organism, the diplococcus intracellularis. Dr. J. Lewis Smith wrote of the first case having occurred in the United States in 1806, since which time epidemics have occurred in all parts of the country.

Etiology and Bacteriology.—The specific organism causing the disease is the diplococcus intracellularis or the meningococcus of Weichselbaum. It is described¹ as of slight viability on all media, the best being agar, to which has been added sheep serum and 2 per cent glucose. Cultures were kept alive five or six days in this media. It is supposed to gain entrance to the system through the nasal mucous membrane and through the

¹ Flexner: Journal American Medical Association, vol. II, no. 4.

upper respiratory tract to the blood stream, or a direct infection through the lymph channels.

Experimenting with guinea-pigs, the following conclusions were reached: (a) Cultures freshly isolated are more virulent; (b) cultures attenuated by artificial growth cannot be rejuve-



Fig. 90.—Pure culture of meningococcus, 36 hours old. Note the irregular staining, the arrangement in pairs of the biscuit-shaped organisms and the approximation of the flat surfaces of the individual bacteria. Note that the division between the individual cocci cannot be determined in many instances. (Sophon. *Epidemic Cerebrospinal Meningitis*.)

nated by passage through animals; (c) autolysis of an attenuated culture may yield an extract which may be used as an adjuvant to increase the activity of other cultures; (d) quantities of cultures injected vary little in effect; (e) guinea-pigs respond relatively very poorly. The nasal mucous membrane has been demonstrated to be a carrier, and hence a disseminator of the meningococcus.

The fact that the organism is present in the naso-pharynx of a healthy person shows how the disease may be transmitted by "carriers."

It occurs both in adults and children, cases as young as three months having been reported; Rotch¹ reports one case in an infant 24 hours old.

Pathology.—The gross pathological changes are much like those in other varieties. There is an intense hyperemia of the meninges of brain and cord, which is followed by an exudate

¹ *Archives of Pediatrics*, October, 1908.

**Series of Microphotographs Illustrating the Change in the
Cerebrospinal Fluid Under the Influence of Serum
Treatment with Improvement.**



Fig. 91

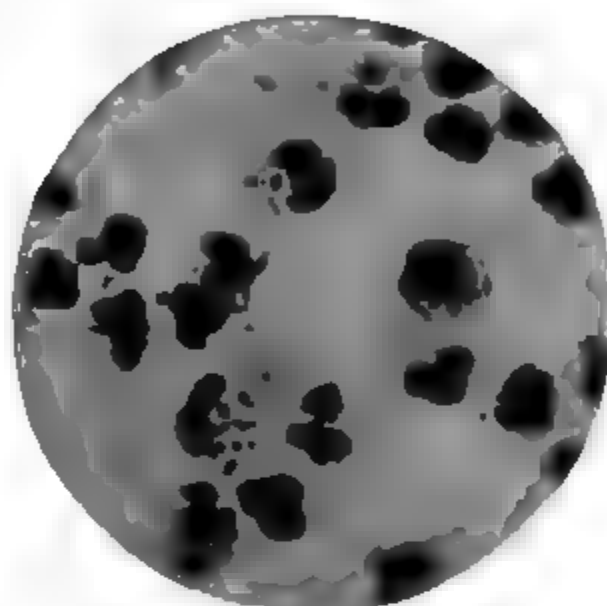


Fig. 92.

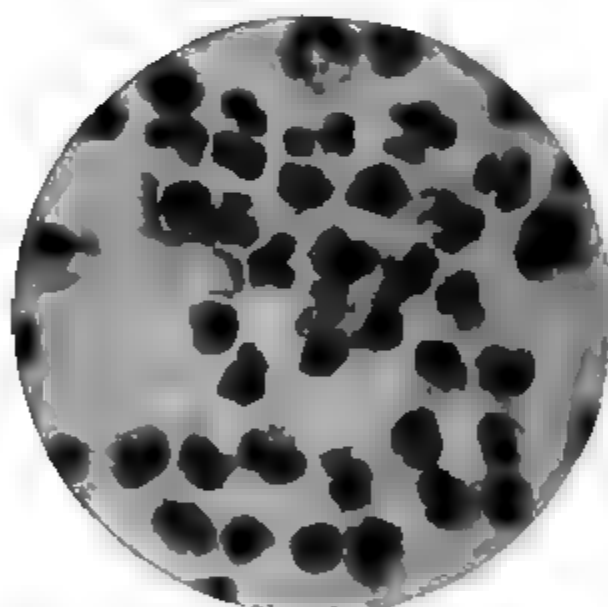


Fig. 93

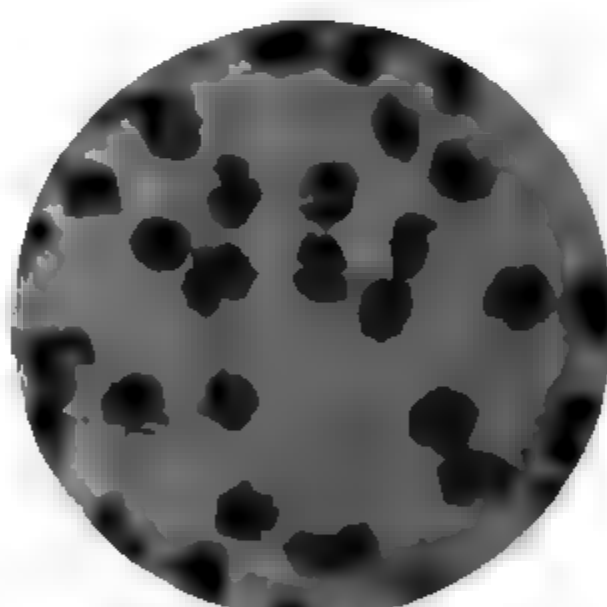


Fig. 94.

- Fig. 91.—Stained sediment of cerebrospinal fluid removed from a case of epidemic meningitis at the beginning of the disease, before serum treatment was instituted. Note the presence of intra- and extracellular diplococci and pus-cells.
- Fig. 92.—Appearance of sediment 24 hours after 30 cc. of serum had been injected subdurally. Note the marked diminution in the total number of bacteria and the fact that most of them are intracellular, only a few being extracellular. This condition was associated with evidence of clinical improvement in the disease.
- Fig. 93.—Stained sediment of cerebrospinal fluid obtained 24 hours after the second dose of antine meningitis serum. Most of the bacteria have disappeared, the few remaining diplococci being intracellular. The pus-cells are more numerous, probably as a direct result of the beneficial action of the serum.
- Fig. 94.—Sediment of the cerebrospinal fluid 48 hours after the third dose of serum. Bacteria have totally disappeared and the cytological picture is changing. A moderate number of lymphocytes are beginning to appear. The patient at this stage was rapidly recovering. (Sophian: *Epidemic Cerebrospinal Meningitis*.)

of thick seropus. The entire surface of the brain and cord is covered with the exudate, which also extends in the fissures of the brain, and between the pia and the cortex, and the ventricles may contain a large amount of fluid. The meningococcus is found in the cells and exudate, and larger numbers of polymorphonuclear neutrophiles than lymphocytes are found. There is a high leucocytosis.

Symptoms.—The onset is as a rule abrupt, but the diagnosis cannot be made on the first day of illness. Vomiting, followed by a chill or rigors and high temperature and very often convulsions, are among the early symptoms. Headache is constant and often agonizing; there is pain in back and neck and early delirium is frequent. Backward retraction of the head and back occur early with rigidity of the neck. The vomiting at this stage is projectile in character. The whole picture is one of an overwhelming infection from the beginning. The fever ranges between 102° and 104° F., but may go very much higher. Reflexes are exaggerated.

A characteristic symptom is the development of an eruption on the body, hemorrhagic in character, at first petechial, then larger bruise-like areas. Herpes is found on lips and face. Kernig's sign is usually present, also Babinski's reflex. Macewen's sign, or the production of a hollow note on percussion over the parietal bones is not a constant or easily obtained sign.

Coma may develop early. Otitis media is sometimes present as a result of an early infection of the middle ear. Purulent conjunctivitis is often present, also corneal, bulbar and conjunctival anesthesia. Maier's¹ observation of muscle soreness, especially in the lumbar, erector spinæ, thigh and upper arm muscles, is a valuable sign.

Several types are seen in the same epidemic, the fulminant and rapidly fatal cases, which die within two or three days; the milder cases, in which the symptoms are not nearly so severe, and those cases which are very mild and of short duration.

Prognosis.—This, under former methods of treatment, has varied in different epidemics. Mortality was from 25 to 75

¹ Royer: Archives of Pediatrics, October, 1908.



Fig 95—Boy of eleven, ill forty-eight hours with epidemic meningitis. He was actively delirious so that he had to be held for the photograph. Note the posture. The head markedly retracted, back bowed. (Sophian: *Epidemic Cerebrospinal Meningitis*.)

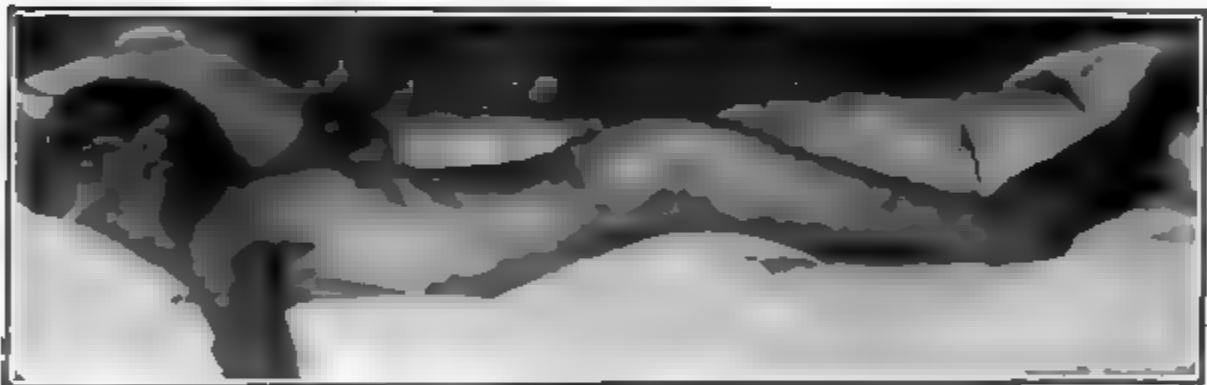


Fig 96.—A boy of thirteen lying in the usual position of those ill with epidemic meningitis. (Courtesy Dr. B. Franklin Royer, Philadelphia.)



Fig. 97—Photograph of a boy ten and one-half years old, taken five days after the onset of epidemic meningitis, showing opisthotonos. (Courtesy Dr. B. Franklin Royer, Philadelphia.)

per cent, while now, under the serum treatment, the recoveries have been 75 per cent. Dunn¹ reports a mortality of 19 per cent in 40 cases treated with the serum. Hence early diagnosis and treatment are very necessary. Flexner² states that so long as the diplococcus is still present in the exudate from the spinal canal, and the mechanical damage to the anatomic structure is not irreparable, the employment of the serum holds out hope of considerable benefit. As a result of serum treatment soon after injection, the diplococci tended to be greatly reduced in numbers, to disappear from the fluid part of the exudate, to become wholly intracellular, to present certain changes in appearance, as swelling and fragmentation, and to stain diffusely and indistinctly, and coincidentally to lose viability in culture.

The exudate in the meninges rapidly loses turbidity under influence of serum injections.

Functional restoration of the meninges is certain even where the exudate has been purulent. Unfavorable indications after several injections of serum are, progressive increase in turbidity of exudate, rise in leucocytosis and greater persistence of the diplococci with retention of viability. Relapse is attended or ushered in by increased exudation of leucocytes in meninges, higher systemic leucocytosis, and reappearance of or increase in the numbers of diplococci; although they may not regain power to grow outside the body in cultures.

Relapses during treatment are not very frequent, and rarely has a case terminated fatally during relapse when the treatment with serum has been resumed without delay and vigorously pushed. The recovery in serum-treated cases is in the great majority of instances complete. The number of complications is small, deafness being a persistent defect.

Diagnosis.—This is best cleared up by use of the lumbar puncture and examination of the cerebrospinal fluid for the specific organism. Injection of the fluid in guinea-pigs may be necessary to clear up the diagnosis. The occurrence of a second or third case in a vicinity is often sufficient to make the diagnosis.

Counting and differentiating the cells in the cerebrospinal

¹ Archives of Pediatrics, October, 1908.

² Loc. cit.

fluid is of great assistance. In this type the polymorphonuclear cells predominate largely; in the tubercular form the predominating cells are lymphocytes, and they are few, and the fluid is much clearer.

Treatment.—The serum treatment of this disease, with the serum discovered by Flexner, is the only one which offers any hope of cure. Of 393 cases reported by Flexner there was a recovery of 75 per cent.

The signs of improvement in the case are shown usually 24 hours after the injection.

To Flexner is due the credit of developing the serum treatment of this disease. He describes the action and administration of the remedy as follows: The action of the serum is antitoxic and bacteriolytic, and is brought into contact with the germs by injection into the cerebrospinal canal after as much cerebrospinal fluid as possible has been drawn off.

The serum is harmless and has brought about a decided reduction in the mortality in the disease, from 80 per cent to less than 30 per cent. After the first injection the number of meningococci free in the fluid outside the cells are decreased, after the second or third injection those in the cells are destroyed and the amount of fluid is less. The serum should always be given by the subdural injection, never subcutaneously.

Lumbar puncture should be performed in every suspicious case at once, and if the fluid is turbid 20 to 30 cc. of warmed serum injected. The fluid withdrawn must be examined for the organism, and if found the injection repeated daily until symptoms are improved. Forty-five cubic centimeters are recommended as the maximum dose of the serum, governed somewhat by the amount of resistance to the serum as it is injected. Doses of 30 cc. are necessary for good results. The dose should be repeated daily as long as diplococci are found in the spinal fluid. At least four daily doses should be given, even if the diplococci disappear earlier. In fulminant cases the injection can be given oftener than once in 24 hours. Reappearance of diplococci is indication for repeating injections.

As a result of the injections the temperature drops in from 3 to 12 hours, and the other symptoms improve, especially the

headache and delirium; pain and hyperesthesia are relieved, coma is lessened, intelligence slowly returns and nourishment is taken. The strabismus and Kernig's sign are more persistent. The polymorphonuclear leucocytes in the fluid increase in number after the first injection.

The question of control of epidemics is a most important one. In cities and towns in which an epidemic exists, strict quarantine of all cases should be maintained, and the nasopharyngeal secretion of recovered cases carefully examined bacteriologically. Municipalities can well afford the furnishing of the serum gratis.

The General Treatment.—The patient should have most careful nursing. If very violent attendants must be provided to prevent the patient from doing himself an injury. Gavage and nasal feeding may have to be resorted to in those profoundly unconscious. Ice applied to the head and neck allays much of the restlessness. Free purgation should be maintained. Hydrotherapy for hyperpyrexia is of service.

ACUTE ENCEPHALITIS.

This is an inflammation of the brain tissue itself.

Etiology.—Any of the acute infectious or contagious diseases may be the exciting cause of this condition. Influenza, the exanthemata, diphtheria, pertussis, pneumonia, erysipelas, ulcerative endocarditis, the acute septic diseases and meningitis may be causes.

Pathology.—The primary condition is hemorrhagic, the inflammatory areas surrounding these spots, round-cell infiltration and degeneration take place.

Symptoms.—It occurs in young children and is preceded by a short period of depression, restlessness and headache followed by great drowsiness or by coma. Convulsions may precede the active symptoms. There is fever up to 104° F. or 105° F., rapid and irregular pulse; shallow, hurried breathing, which becomes irregular or Cheyne-Stokes, as the disease progresses.

Motor and sensory symptoms develop according to the area most involved. Rigidity of the neck is present early, paralysis or hemiplegia may present, ocular palsies often develop; deafness is usually present early, and if recovery takes place the hearing is not reëstablished.

Prognosis.—This is very grave, but varies according to the extent of involvement of the brain. If some remission in the symptoms is noted by the end of the first week the prognosis is more favorable.

Treatment.—Absolute rest; calomel purgation, ice to head and spine, and a blister to the cervical region of the spine. Supportive and sedative treatment may be indicated at different times.

HYDROCEPHALUS.

This is an accumulation of cerebrospinal fluid either in the subdural spaces or in the ventricles. It may be congenital or acquired, primary or secondary, acute or chronic.

ACUTE HYDROCEPHALUS.

Etiology.—Trauma may be a factor, and it probably is of microbic origin, though nothing definite is known of its cause. It may be due to tuberculosis or syphilis. A condition known as meningitis serosa may exist, following trauma or infectious diseases.

Pathology.—Inflammation of the brain or meninges, venous or lymphatic stasis may be present. The accumulation of fluid in the ventricles may continue and be so great as to cause thinning of the brain from internal pressure.

Symptoms.—Slight fever may usher in the condition, continuing a few days and gradually subsiding, with perhaps a rise at a later date. Headache is one of the earliest of the subjective symptoms, associated with retraction of the neck, and probably opisthotonos. Bulging of the fontanelles takes place. Headache, blindness, stupor and coma may be present. As the fever drops to normal all of these symptoms may be relieved for a short period, and again come on as the temperature rises. There may be no improvement, the child succumbs to intracranial pressure. The opposite may obtain, the symptoms growing less in severity and the child finally recovering. Symptoms are sometimes relieved by lumbar puncture, nothing abnormal being found in the fluid.

Prognosis.—This depends largely upon the cause of the condition and its severity. Cases do recover in which the diagnosis

is positive. Recovery or amelioration of all symptoms but the blindness may occur. In general the prognosis is unfavorable.

Treatment.—Lumbar puncture is indicated and should be repeated if the effects of the first have been good. This treatment gives the only hope of cure, as no medication is of avail.

CHRONIC HYDROCEPHALUS.

The typical form of this variety is the congenital type, though a further subdivision is made by some authorities.

Etiology.—The cause of the congenital form is not known. I delivered a dead child at term with an enormous hydrocephalus, in which the cord was wrapped tightly around the neck three times, enough pressure being exerted to make a deep groove in the neck in which the coils of cord rested.

It occurs where both parents are perfectly healthy, and not infrequently it is the first-born so affected, and later children are perfectly normal. Mother and daughter have been known to have a hydrocephalic first-born. Syphilis, alcoholism, tuberculosis in the parents have been given as causes.

In this form the head is enlarged at birth and may be the cause of dystocia. It continues to enlarge after birth. Not infrequently associated with the hydrocephalus is an imperfect closure of the spinal canal, spina bifida, or one of the varieties of talipes.

Enormous accumulation of fluid may take place in the ventricles, distending them and compressing the brain until it is greatly attenuated.

The sutures are widely separated, especially the frontal, coronal and sagittal, and the fontanelles are very large and bulging.

Symptoms.—The first thing noticed in these infants is the very high, bulging forehead, with an upward tilting of the eyes and a tendency to exophthalmos. As the fluid increases a nystagmus is apt to begin. There may be a stationary period in which the head does not enlarge, and the child may be able to hold it up without special support, but as the fluid increases in amount the head cannot be raised from the pillow or turned.

It is often surprising the amount of intellection exhibited

in these cases, which at autopsy show such thinning of brain tissue.

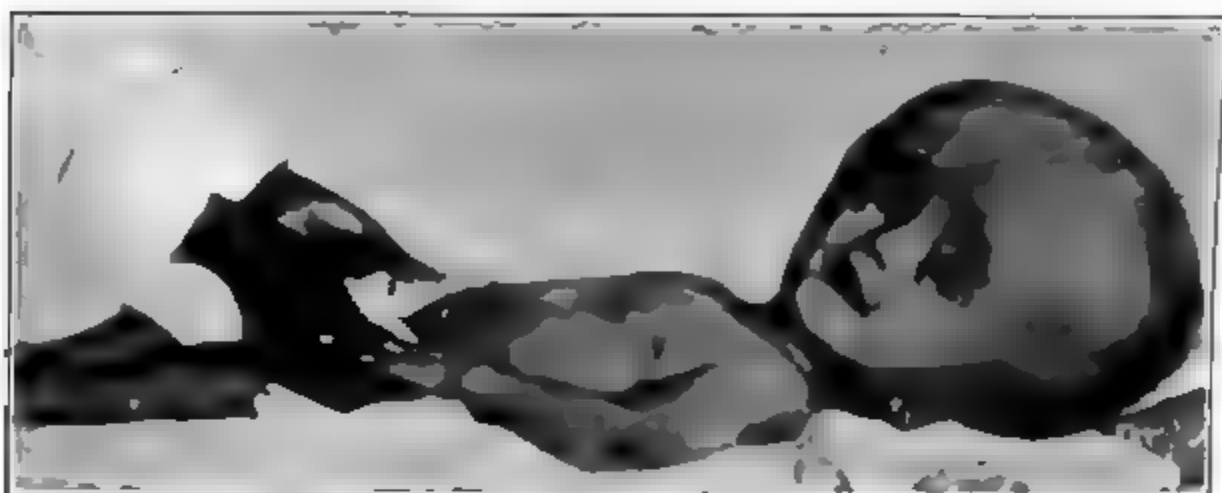


Fig. 98.—Hydrocephalus Child six years old

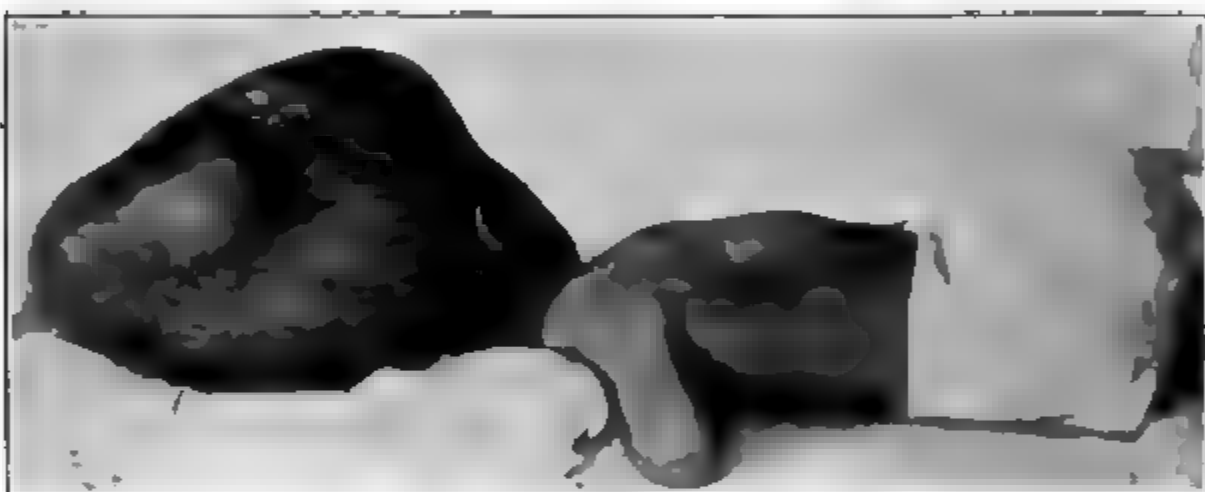


Fig. 99.—Side view same child.

The following history of child whose pictures are shown is of interest. Female, colored, 6 years old. Third child, others normal. Had a convulsion when 12 days old. Head began enlarging at 6 weeks. At 3 weeks had bronchitis, 2 years of age measles; 3 years whooping-cough. Cut first tooth at one year of age. Circumference of head 32½ inches, from occipital protuberance to bridge of nose 29 inches. This child died when 6½ years old.

A case which was under my observation when an interne at the New York Infant Asylum was admitted during the service of Dr. L. Emmet Holt, and through whose courtesy the case was reported in the *American Practitioner and News*, January 2, 1892.

She was the fourth child of healthy, German parentage; head large and soft, with bulging fontanelles at birth. At the age of one month the head measured 19 inches in circumference, and while under observation the gain in circumference was at the rate of half an inch a week.

There was a divergent strabismus, axis of eyes turned upward, pupils active and followed light; no contractures, rigidities or convulsions.

The child died at the age of four months, and the head was $24\frac{1}{2}$ inches in circumference, 16 inches from ear tip to tip, and from occipital protuberance to bridge of nose, 20 inches. Eighty-eight ounces of fluid were withdrawn by a trocar. The brain in its thickest portion at the base varied from $\frac{1}{2}$ to $\frac{3}{4}$ inch in thickness. There was free communication between the lateral ventricles and the third ventricle at the base. The medulla, pons and cerebellum appeared normal. There was no evidence of meningitis or tumor.

Diagnosis.—This must be made from *rachitis*, and should be easy. The enlargement of bone at the centers of ossification, the other bony changes, headsweats, etc., make the diagnosis of rachitis easy.

Prognosis.—This is always serious and a guarded opinion should be given, even where there is an apparent improvement in intellection and no progressive enlargement of the head.

Treatment.—This is entirely symptomatic and palliative as no medicine which may be given can cause an absorption of the fluid.

Drainage of the fluid by tapping the ventricles through the fontanelles or by lumbar puncture may prove efficacious in some cases, and should be repeated if found so.

CEREBRAL PALSIES OF CHILDHOOD.

Synonyms.—*Spastic hemiplegia; spastic paraplegia or diplegia.*

Etiology.—The most frequent and potent factor in the cause of these conditions is a much-delayed labor, in the first-born, very often, and the injudicious or faulty use of the obstetrical forceps. Asphyxia at the time of birth may play a part in its causation. Injury to the mother during the last weeks of gestation may be a cause. Hemorrhages in the brain or brain injuries are the active causes.

Heredity should be considered. There may be a distinct history of similar children affected in the parents' family.

The acute exanthemata may act as a cause of the acute palsies. Trauma after birth may also act as a cause. Convulsions and whooping-cough may give rise to pathologic conditions in the brain which would result in spastic paralysis.

Pathology.—In those cases being present at birth, more severe lesions are generally found, as a porencephaly, defective development of the brain or parts of it; meningeal hemorrhages; cysts; thrombosis or embolism, meningitis or encephalitis, sclerosis, hydrocephalus, and failure of development of the cortical cells.

Symptoms.—Usually three types are described, according to the body area involved, viz.: *Cerebral spastic hemiplegia*; *spastic paraplegia*.

The symptoms vary according to the time of development, the situation and extent of the brain involvement. If it occurs directly after birth there may be convulsions, coma and cyanosis. In those developing later, convulsions mark the onset. Many cases appear during the first year of life, and fully two-thirds, perhaps more, begin in the first three years of life. Convulsions may recur at fairly regular intervals for some time after their onset.

When of the leg, there is a decided limp and spastic gait. Some contracture is nearly always present. Athetoid and choreiform movements may be seen of the affected muscles.

The paralyses are at first flaccid, but they rapidly become spastic, the paralyzed side remains smaller and undeveloped. Idiocy is one of the important sequels, it may develop in a short while after the onset of the trouble.

In *quadriplegia* all four extremities are involved, extensive injury to the brain probably having taken place. All of the symptoms in a hemiplegia are present in this form, only more severe.

In *paraplegia* only the lower extremities are involved, and the lesion is very apt to be at the apex of the brain.

Diagnosis.—The spastic character of the paralysis, the diminished intelligence, age of patient and history of the onset is usually sufficient to make a diagnosis. Reflexes are normal or exaggerated in contradistinction to other similar conditions having no reflexes.

Prognosis.—This is unfavorable, but cases do show an improvement when the severe form of paralysis was present early. The early development of failing intellection is grave. Repeated

convulsions make the outlook bad. If no improvement takes place in the contractures, the prognosis is not so good.

Treatment.—Prophylaxis is most important. Intelligent care of all labors, intelligent interference when indicated, effectually prevent injuries occurring during childbirth. Owing to the idiocy, these cases do best where they are under constant surveillance, hence the importance of confining them at a public institution, if possible.

Proper hygiene, diet and general supervision of the life of the child is necessary. Orthopedic surgery is indicated always, where large amount contractures are present.

TUMORS OF THE BRAIN AND MENINGES.

Tumors of the brain are comparatively frequent in childhood. Peterson has reported 335 cases as follows:

TABLE I.

<i>Form of Tumor.</i>	<i>No. of Cases.</i>
Tubercle	166
Glioma	42
Sarcoma	37
Cyst	35
Carcinoma	11
Gliosarcoma	5
Angiosarcoma	1
Myxosarcoma	1
Papillary epithelioma	1
Gumma	1
Not stated	35
Total	335

TABLE II.

<i>Site of Tumor.</i>	<i>No. of Cases.</i>
Cerebellum	105
Pons Varolii	42
Centrum ovale	41
Basal ganglia and lateral ventricles	30
Corpora quadrigemina and crura cerebri	25
Cortex cerebri	23
Medulla oblongata	7
Fourth ventricle	6
Base of brain	8
Total	287

Tubercular tumors are more often met than any other variety, and they are found most frequently in the cerebellum.

Etiology.—With the exception perhaps of gliomata, tumors of the brain are secondary to growths of like character elsewhere in the body. A glioma may result from an injury or blow.

Pathology.—The tubercle may occasion a variety of growths and affect any part of the nervous system. It occurs as a solitary tubercle or as multiple tumors, and tuberculosis in other parts of the body, as the bronchial glands, lung, mesentery, etc., is the starting point of the infection. They vary in size very much, from a pea to a growth which occupies a greater portion of the brain. These tumors are as a rule encapsulated, and may on section show softened areas in the center. Bacilli may be demonstrated, and in this way they are differentiated from other varieties of tumor.

Glioma is a growth which is found beneath the gray matter in the white matter, as a rule, though it may involve the former also. It is a slower growth than the others. An increase in the blood supply is present in the areas involved in this growth. The mass is not encapsulated, and is much softer than the surrounding tissue.

Cysts are quite frequently encountered—found in brains when least expected. The origin of these cysts was evidently a hemorrhagic or other process occurring in infancy.

Gumma may occur in hereditary syphilis, but is rare.

Symptoms.—These may be considered from the standpoint of the intracranial pressure and cerebral localization of the growth.

We believe that these growths are very frequently not diagnosed on account of the vagueness and indefiniteness of the symptoms. They vary greatly according to the rapidity of the growth, the amount of intracranial pressure from it, coincident increased blood supply, and hydrocephalus which follows.

Among the *general symptoms* may be mentioned:

Headache.—This may be the most striking symptom, both as to its severity and persistence. The pain is boring or knifelike and causes restlessness, photophobia and the typical cephalic cry.

If the meninges are involved it will be more severe and localized, perhaps associated with tenderness.

Nausea and *vomiting*, in connection with a more or less continuous headache, in a child is a suspicious occurrence. The vomiting, if projectile, is quite characteristic of brain involvement, and later it occurs without nausea and irrespective of food.

Convulsions, in connection with headaches, are suspicious, and especially so if the projectile vomiting is also present.

Vertigo and *dizziness* are quite commonly present.

Optic neuritis, from the intracranial pressure, is an early symptom, perhaps preceded for a short time by choked disc. Blindness is not uncommon. Only one side may be involved, usually it is double. A careful ophthalmoscopic examination of the eyes should be made in all suspicious cases.

The *pulse* at the end becomes rapid and weak, and not infrequently the respirations show the typical Cheyne-Stokes' type.

Localization Symptoms.—This is a special study in itself, and the reader is referred to any late text-book on nervous and mental diseases for a detailed description of these diagnostic methods.

Diagnosis.—From *abscess* by the presence of fever, and possibly sweats in the latter. Abscess also forms more quickly, and previous history, perhaps of middle ear or frontal sinus disease, which are suggestive.

In *tubercular meningitis* which is prolonged the diagnosis may be difficult. Headache is usually more severe in meningitis. Lumbar puncture is of assistance in making a diagnosis.

Prognosis.—This is extremely grave no matter what the character of the growth, and even if diagnosed surgery offers very little hope of cure. Gummata, one of the least frequent forms of growth, may yield to specific treatment.

Treatment.—Surgery is practically the only form of treatment which offers any hope of relief, and the outlook is exceedingly grave; even with skilled surgery children bear operative measures on the brain badly. The coal-tar products, with caffeine and codeine, may have to be tried for the relief of the headaches. The bromides and chloral are of service in certain cases, and the regulation of the diet most essential.

Because of the disseminated form of the growth of glioma and sarcoma, operations for their removal are not as successful as in other forms.

ABSCESS OF THE BRAIN.

A much more frequent condition in children than in adults.

Etiology.—The most frequent cause is a preceding middle-ear or mastoid suppuration. Trauma is also a frequent cause, and disease of the nose and frontal sinuses also. Abscess of the brain follows venous infection and lateral sinus involvement in middle-ear disease most frequently.

Pathology.—Rarely, small, walled-off collections of pus may be found postmortem which were not previously suspected. Larger collections of pus may be walled off, others show no distinct limiting membrane. It may be located in any part of the brain, beneath the dura or external to it entirely. A number of the pus-producing organisms may be found in the pus from these abscesses. They occur most often, perhaps, in the frontal and temporosphenoidal lobes.

Symptoms.—Abscesses located deep in the brain tissue may cause no symptoms unless they are large enough to give symptoms of intracranial pressure. They are difficult of diagnosis. Following operations on the middle ear or mastoid, the diagnosis is much easier. Headache, vomiting, irregular fever and rigors, drowsiness, coma or convulsions are a train of symptoms which are convincing. Cerebral localization, as in brain tumors, must be brought into consideration if the site of the abscess is to be diagnosed.

Diagnosis.—If a history of previous inflammations contiguous to the brain is obtainable, the diagnosis is easier.

From solid tumors, the presence of rigors and irregular temperature is a diagnostic sign.

In meningitis and inflammation of the lateral sinus, the onset is much more sudden and the range of temperature higher. In meningitis, in addition, there is apt to be retraction of the head and rigidity of the neck.

An important diagnostic aid is a differential blood current.

Prognosis.—This is extremely grave. It is influenced by the

location, size and duration of the abscess, and its accessibility for surgical intervention.

Treatment.—Prophylaxis is of importance in ear and nasal disease, especially of suppurating variety. Prevention of extensive involvement in middle-ear abscess by early paracentesis is indicated in all cases. Free and radical operation in mastoid abscess is the best treatment.

Brain abscess can be treated successfully only by surgery, and careful exploratory operation.

INTRACRANIAL HEMORRHAGE.

Hemorrhage within the skull of the new-born may be *subdural*, or within the brain substance, *cerebral*.

Etiology.—This may be due to the general hemorrhagic diathesis or disease, or if it is present at birth due to causes existing during labor, either long-continued pressure during the second stage, trauma of forceps delivery, or forcible extraction of the after-coming head in breech presentations.

Symptoms.—A large hemorrhage, *subdural* in character, may be present at birth or occur shortly after, in which event the child is either still-born or asphyxiated. A hemorrhage is the most frequent cause of convulsions in the new-born. These are more often localized and not general. A hemorrhage of sufficient size to cause general convulsions is usually enough to cause the death of the child. If the hemorrhage is slow the pressure symptoms will not be so severe and the child may live some time, and a condition of cerebral atrophy will develop.

Cerebral hemorrhage is more often seen in older children, and may occur as a complication of the infectious diseases. The hemorrhage causes a period of sudden unconsciousness, followed by a paralysis more or less extensive, according to the area involved by the compression. Recovery may take place, but rarely.

Prognosis.—In subdural hemorrhage, if the primary asphyxia is relieved, the child may recover, to be afflicted with one of the cerebral palsies later.

Treatment.—Artificial respiration is used to overcome the primary asphyxia. Great discretion should always be used in labor as to when interference is justifiable, to intelligently choose

between the evils resulting from prolonged labor and those which follow instrumental delivery. In competent hands forceps will prevent trouble far more frequently than they will do harm.

After the occurrence of the hemorrhage but little can be done, medically or surgically.

CHAPTER XXIII.

DISEASES OF THE SKIN.

Owing to the very delicate structure of the skin in childhood many skin diseases at that period are different from those seen in adults. At this age the skin is much more susceptible to effects of irritants, and a number of lesions may result from mechanical causes, heat or cold, light, medication, etc.

INTERTRIGO.

This is a very common condition, and is a chafing or rubbing off of the superficial skin, which has been previously macerated. Its most frequent site is the buttocks, in folds between the buttocks, in the groins, and the scrotum. The chief cause is the practice of drying the napkins several times before washing them, or neglect in removal of fecal discharges.

The primary lesion is an erythema, with deep congestion of the skin. Maceration takes place, and a superficial layer of epidermis is rubbed off. This leaves a moist, red surface, which, if an infection takes place, becomes inflamed, covered with pus and encrustations.

Treatment.—Prophylaxis is most important. Intertrigo is generally an indication of carelessness on the part of the nurse. Napkins should be properly cared for, boiled daily, without strong alkaline washing powders. Soap should not be used on the skin of the buttocks frequently. A soft cloth and warm water should be used after evacuations, followed by a drying powder.

When the first symptoms develop all digestive disturbances should be corrected, that the discharges may be as unirritating as possible and the urine examined for hyperacidity. The napkin should be changed immediately it is wet or soiled, both day

and night, and should not be used again without having been washed.

Stearate of zinc powder applied to the affected area as soon as cleansed and dried will frequently correct the condition promptly. If much thickening and congestion of the skin is present, Lassar's paste will be found efficient.

SUDAMINA, MILIARIA.

This eruption, usually called "heat" is characterized by minute papules, which are surmounted by transparent vesicles, due to the collection of sweat under the epidermis. Some erythema is seen between the patches.

Associated with this rash is usually considerable itching, the child scratching even in its sleep.

The eruption is general, but chiefly located on the chest, neck and back.

The vesicles rupture leaving a roughened surface, followed by a fine, scaly or branny desquamation.

Treatment.—Cool sponging, followed by drying with a soft cloth and free use of talcum powder, gives comfort and relief from the itching and assists in drying up of the vesicles.

PARASITIC SKIN LESIONS.

PEDICULOSIS.

This is an infection of the hair of the body with animal parasites, affecting the hair of the head, and in older children the hair of the pubes and body.

PEDICULOSIS CAPITIS.

This form is due to the invasion of the hair of the head by the parasite *pediculus capitis*.

The headlouse is grayish in color, 1 to 3 mm. in length, oval in shape, with six legs, containing claws arising from the anterior portion. One female is capable of laying about 50 eggs, which hatch in about a week, and the new parasites are capable of reproduction in about three weeks. The eggs or nits are attached to the side of the hair one-fourth to one-half an inch from

the scalp, usually two or three to a hair, and can be easily seen by the naked eye. The occipital and temporal regions are more thickly contaminated than the rest of the head.

Pediculi obtain nourishment by sucking blood from the scalp, this causes severe itching, resulting in scratching, with abrasions and infections of the skin, a variety of exudations forming on it. If many of these are present the postcervical and submaxillary glands may become enlarged from absorption of pus. With large encrustations and matting of the hair there is a very disagreeable odor to the head.

Diagnosis.—Examination of the head should always be made where great itching is present. The nits can easily be found, and usually a parasite, especially if a fine tooth comb is run through the hair. A pustular encrustation on the scalp and neck is a suspicious occurrence.

Treatment.—Both the pediculi and the ova must be destroyed. If in a girl with long hair and the infection is very great, a cure will be much more rapid by cutting the hair or boxing it. In a boy this can be easily done. The use of the fine tooth comb is necessary.

A number of remedies have been advocated, none, however, infallible.

The head should be washed with green soap and the following applied:

R Kerosene oil

Ol. olivæ

āā ʒiv

M. Sig.: Applied to the hair and thoroughly rubbed in, the head tied up in a towel and allowed to remain over night.

The hair is shampooed the next morning with green soap, and this treatment repeated each night for three nights.

Tincture of *coccus indicus*, diluted one-third, can be applied in the same way; also bichloride of mercury, gr. i to the ounce of water. To soften and remove the ova a solution of bicarbonate of soda or of dilute acetic acid can be used to advantage.

PEDICULOSIS CORPORIS.

This is due to the *pediculus corporis*, a louse larger than the headlouse. It reproduces itself in the underclothing, the ova

Because of the disseminated form of the growth of glioma and sarcoma, operations for their removal are not as successful as in other forms.

ABSCESS OF THE BRAIN.

A much more frequent condition in children than in adults.

Etiology.—The most frequent cause is a preceding middle-ear or mastoid suppuration. Trauma is also a frequent cause, and disease of the nose and frontal sinuses also. Abscess of the brain follows venous infection and lateral sinus involvement in middle-ear disease most frequently.

Pathology.—Rarely, small, walled-off collections of pus may be found postmortem which were not previously suspected. Larger collections of pus may be walled off, others show no distinct limiting membrane. It may be located in any part of the brain, beneath the dura or external to it entirely. A number of the pus-producing organisms may be found in the pus from these abscesses. They occur most often, perhaps, in the frontal and temporosphenoidal lobes.

Symptoms.—Abscesses located deep in the brain tissue may cause no symptoms unless they are large enough to give symptoms of intracranial pressure. They are difficult of diagnosis. Following operations on the middle ear or mastoid, the diagnosis is much easier. Headache, vomiting, irregular fever and rigors, drowsiness, coma or convulsions are a train of symptoms which are convincing. Cerebral localization, as in brain tumors, must be brought into consideration if the site of the abscess is to be diagnosed.

Diagnosis.—If a history of previous inflammations contiguous to the brain is obtainable, the diagnosis is easier.

From solid tumors, the presence of rigors and irregular temperature is a diagnostic sign.

In meningitis and inflammation of the lateral sinus, the onset is much more sudden and the range of temperature higher. In meningitis, in addition, there is apt to be retraction of the head and rigidity of the neck.

An important diagnostic aid is a differential blood current.

Prognosis.—This is extremely grave. It is influenced by the

location, size and duration of the abscess, and its accessibility for surgical intervention.

Treatment.—Prophylaxis is of importance in ear and nasal disease, especially of suppurating variety. Prevention of extensive involvement in middle-ear abscess by early paracentesis is indicated in all cases. Free and radical operation in mastoid abscess is the best treatment.

Brain abscess can be treated successfully only by surgery, and careful exploratory operation.

INTRACRANIAL HEMORRHAGE.

Hemorrhage within the skull of the new-born may be *subdural*, or within the brain substance, *cerebral*.

Etiology.—This may be due to the general hemorrhagic diathesis or disease, or if it is present at birth due to causes existing during labor, either long-continued pressure during the second stage, trauma of forceps delivery, or forcible extraction of the after-coming head in breech presentations.

Symptoms.—A large hemorrhage, *subdural* in character, may be present at birth or occur shortly after, in which event the child is either still-born or asphyxiated. A hemorrhage is the most frequent cause of convulsions in the new-born. These are more often localized and not general. A hemorrhage of sufficient size to cause general convulsions is usually enough to cause the death of the child. If the hemorrhage is slow the pressure symptoms will not be so severe and the child may live some time, and a condition of cerebral atrophy will develop.

Cerebral hemorrhage is more often seen in older children, and may occur as a complication of the infectious diseases. The hemorrhage causes a period of sudden unconsciousness, followed by a paralysis more or less extensive, according to the area involved by the compression. Recovery may take place, but rarely.

Prognosis.—In subdural hemorrhage, if the primary asphyxia is relieved, the child may recover, to be afflicted with one of the cerebral palsies later.

Treatment.—Artificial respiration is used to overcome the primary asphyxia. Great discretion should always be used in labor as to when interference is justifiable, to intelligently choose

The child is given a hot bath with thorough soaping and vigorous rub with rough towel afterward. The towel is boiled before again being used. After this the whole body affected is anointed with an ointment containing sulphur, or sulphur and balsam of Peru, as follows:

R Sulphur precip.	gr. xl
Balsam Peruv.	ʒi
Adipis	
Vaseline	āā ʒss
M. ft. ung.	

or

R Beta naphthol	gr. xxx
Balsam Peru	ʒi
or Sulphur precip.	gr. xl
Vaseline	ʒi
M. ft. ung.	

This method of treatment is repeated each of three succeeding nights, and at the end of this time precipitated sulphur is sprinkled between the sheets at bed time. Sheets and night clothes are changed each day.

RINGWORM.

Ringworm is named according to the site affected, of the scalp, *tinea tonsurans*; of the body, *tinea circinata*; of the groin, *tinea cruris*.

Two spore fungi have been found as cause, of these conditions, the small spore, *microsporon audouini*, and the large spore, *trichophyton*.

There are several varieties of each fungus.

TINEA CIRCINATA.

Lesions due to the microsporon appear on any part of the body, often upon the backs of the hands.

Symptoms.—It begins as a small, scaly, papular patch, soon assuming a circular form, the outer ring generally being slightly elevated and scaly. As the ring enlarges the skin within becomes shiny and tense and of a deeper color than the healthy skin. One or two, or many ringworm patches, may be found. It may occur with or without an involvement of the scalp.

One source of infection is through the medium of domestic pets, cats and dogs.

Pathology.—A scraping from the scaly patch, treated with liquor potassæ, 10 to 30 per cent solution, after 10 or 15 minutes shows under the microscope a network of mycelial threads, bifurcated, with fewer spores. The latter are round, about 1/800 of an inch in diameter.

Treatment.—Painting the patches with the tincture of iodine is usually sufficient to cure. This may be repeated once daily for two or three days. Any of the parasiticide drugs in the form of an ointment may be used as follows:

℞ Ung. sulphuris	ʒi
Ac. carbolic	gr. x
M. ft. ung.	

℞ Hydrargyri ammoniat.	gr. xx
Ung. zinci oxidi	
Vaseline	āā ʒss
M. ft. ung.	

℞ Beta naphthol	gr. xx
Resorcin	gr. xii
Ung. aquæ rosæ	ʒi
M. ft. ung.	

TINEA TONSURANS.

Synonyms.—*Ringworm of scalp.*

A disease of the scalp due to the trichophyton tonsurans, characterized by a disease of the hair which causes it to fall out, leaving circumscribed areas of baldness, with scaly surface.

Etiology.—This disease is due to the trichophyton tonsurans, or the microsporon audouini. It affects children, in the main, and is directly transmitted from child to child, or through the medium of combs or brushes, towels, caps, bedding, etc. A cat, dog or rabbit may convey the organism.

Pathology.—An examination of a hair from the diseased area, or a scale from the epidermis, treated with a 20 per cent potassæ solution, the spores can be easily seen under the scale when viewed with a 1/6 inch lens. They are attached in num-

bers to the hair, and the mycelial threads run longitudinally. The hair is broken off leaving a rough end.

Symptoms.—The disease begins upon any portion of the scalp, being at first limited to the scalp, but later on affecting the hair and hair follicle. The period in which only the scalp is involved may be entirely overlooked as practically no symptoms present. The first evidence may be a bald spot appearing upon some part of the scalp, the hair being broken off and the skin in the area, as a rule, scaly in appearance. These areas vary in size from a five-cent piece to the size of a silver dollar. On an attempt to pull out a hair in the diseased area the hair breaks close to the scalp.

A differentiation is made by dermatologists of the lesion caused by the large and small spores. In the large-spored type, or the *trichophyton* or *endothrix* variety, the lesions are much smaller in size than the small-spored type.

The course of the disease is slow and prolonged, as it may remain for years if treatment is not instituted and conscientiously carried out.

Diagnosis.—The occurrence of circumscribed areas of baldness in one or more places in the scalp is characteristic of ringworm. An examination of the hair treated by liquor potassæ under the microscope will clear up the diagnosis.

It must be diagnosed from alopecia. This is usually more rapid in its course, and the scalp affected smooth and soft, the hair apparently normal, at least not brittle, and contains no spores.

Prognosis.—This is one of the most intractable of the skin lesions of childhood, and requires several months of active and persistent treatment before a cure can be obtained.

Treatment.—Careful segregation of ringworm subjects should be insisted upon, and they should be made to wear a skull cap made of muslin at all times so as to prevent the dissemination of scales and broken hairs containing the spores.

The hair should be closely clipped from the whole head, or if a girl, and this is objected to, a small area around the affected spot should be closely cut. The diseased area is vigorously rubbed with green soap, or its tincture, and with a nail

brush thoroughly scrubbed each morning, followed by the application of the medicament decided upon, for the purpose of destroying the spores. This can be done only by producing an inflammatory reaction in the skin of the affected area. The following has been recommended as effective for this purpose:

- | | |
|-------------------------------|----------|
| ℞ Sodium chloridi | |
| Vaseline | āā ʒss |
| M. ft. ung. | |
| ℞ Sulphur precipitat. | |
| Beta naphthol | āā ʒi |
| Balsam Peruv. | ʒss |
| Vaselini | ʒi |
| M. | |
| ℞ Hydrargyri bichloridi gr. i | |
| Kerosene oil | |
| Ol. olivæ | āā ʒss |
| Alcoholis | q.s. ʒiv |
| M. | |
| ℞ Ol. Tiglii | ʒi |
| Sulphur precipitat. | ʒii |
| Vaseline | ʒi |
| M. ft. ung. | |

Equal parts of oil of cade and castor oil have been recommended.

Any one of these applications is to be used once daily, until an inflammatory reaction is obtained, when it is discontinued for a few days, and a simple ointment, as a 3 per cent boracic acid ointment applied until the reaction disappears, when the original ointment is again applied.

For the intractable cases the X-rays have been recommended, with 10 to 15 minutes' exposure, static current and high vacuum tube are suggested as most beneficial.

TINEA FAVOSA.

Synonym.—*Favus*.

Etiology.—This is a disease most frequently affecting the scalp, due to a mould fungus, *Achorion Schoenleinii*, and is contagious. It usually begins in childhood, and most frequently

among the poor, especially in foreigners, Poles, Russians and Jews. The domestic pets may cause its dessemination.

Pathology.—The epidermis, hair and hair follicles are involved. The crusts which form in favus are much thicker than in ringworm, it is cup-shaped, the *scutulum*, yellowish in color, and made up of mycelia and spores. The area beneath a scutulum is red, moist and free of hair. They have a peculiar odor.

Symptoms.—The scalp is more often affected, and also areas of the body, and either may be affected alone. The occurrence of the favus cup or scutulum, the size of a split pea, the concave side up, usually with a hair in its center, is the first diagnostic sign, and when dislodged leaves a moist, often bleeding area, slightly depressed, beneath. If the inflammation is extensive, the cups may coalesce. The hair looks dead, but is not as brittle as the hair in ringworm. Itching is usually present. Healed areas on the scalp show slightly depressed bald scars.

Diagnosis is to be made from eczema and ringworm. It may be difficult to make a diagnosis from ringworm of the body if the characteristic lesion is not present in the scalp also. The scutula do not appear in any of the other diseases mentioned.

Prognosis.—This is very unfavorable, as a cure is obtained with difficulty.

Treatment.—The hair in the affected area must be pulled out after removing the scutula. Applications of a strong solution of bicarbonate of soda will accomplish this. The scalp can be soaked with oil and the crusts scraped off. Epilation can proceed when the affected area is clean, and is a very tedious process, as each hair must be carefully pulled out separately. Bulkley recommends the following stick for epilation:

R Ceræ flavæ	3ii
Laccæ in tabulas	3iv
Picis burgundicæ	3x
Gummi damar	3iss
M. Moulded into stick.	

The end of the stick is melted and when warm applied to the hair and twisted off when cold.

Any of the applications recommended for *tenia tonsurans*

can be used to advantage in favus, followed by vigorous cleansing with green soap and water.

In addition, the following can be used:

R	Chrysarobin	gr. xv to xx
	Vaseline	ʒi

M.

R	Hydrargyri oleat.	gr. x
	Vaseline	ʒi

M.

R Pyrogallol 5 per cent.

R Acetic acid sprayed on the scalp in an atomizer.

The X-rays may be used in intractable cases the same as in ringworm of the scalp.

IMPETIGO CONTAGIOSA.

Etiology.—Due to the invasion of the skin by the pus organisms, and it is common among the children of the poor. It is not infrequently epidemic in institutions, when it once obtains a start. Scratching in pruritus, scabies and pediculosis may cause it.

Pathology.—The staphylococcus aureus is believed to be most regularly present, though Fox has described the finding of the streptococcus also.

Symptoms.—The initial lesion is a vesicle, which quickly changes to a pustule, varying from the size of a pin head to a five-cent piece. The pustules rupture, their contents forming in a scab or crust. These can be removed, usually being attached to the hair, and leave a moist, bleeding area beneath. The pustules and the encrustations may coalesce, forming one large crust over the affected area. They are very superficial and leave no scars.

The parts affected are chiefly the exposed parts of the body, and others may soon become affected by autoinoculation. The glands nearby may become enlarged.

Diagnosis.—The very superficial character of the vesicles,

pustules and crusts, and the evident inoculation of other parts, is enough for the diagnosis. It is to be diagnosed from pustular eczema, pemphigus and varicella, and should be easy.

Treatment.—The first indication is to remove the crusts. No medication will be of avail through these. Any oily substance will soften them, and they can be washed off with warm water and green soap. Bicarbonate of soda solution is helpful for this also. One of the following is then applied:

R	Ichthyol ammon. sulph	3iss
	Vaseline	3i
M.		
R	Ung. hydrargyri ammon. chlor.	gr. v
	Vaseline	3i
M.		
R	Hydrargyri chloridi mitis	gr. v
	Vaseline	3i
M.		
R	Resorcin	gr. x
	Ung. aquæ rosæ	3i
R	Acid boracic	gr. xx
	Vaseline	3i
M.	Sig.: Useful in the later stages.	

Vaccines may be found beneficial in intractable cases; the mixed stock, staphylococcus or autogenous vaccine may be used.

PEMPHIGUS VULGARIS ACUTA.

This is a rather rare condition in children. Duhring reports 16 cases in 16,863 cases of skin disease. It is characterized by the development of bullæ or blebs, with more or less constitutional symptoms.

Other varieties of pemphigus, even more rare, are described, viz., *pemphigus vegetans* and *pemphigus foliaceus*.

Etiology.—Nothing is known definitely of the causation of this disease. There may be a connection between it and the nervous system.

Pathology.—The blebs may involve all of the layers of the

skin, or only the epidermis. The contents of the blisters is a straw-colored fluid, containing leucocytes, and an infiltration of the entire skin. There may be an infection of the bullæ and absorption of toxic products.

Symptoms.—Usually there are systemic symptoms preceding the development of the blebs, malaise, rigors or a chill, with a moderate rise of temperature. Slight pain or a stinging sensation may be felt at the site of the developing bleb or bulla, or a macular spot may develop, followed at once by the blister upon it. The blisters vary from the size of a split pea to an area 2 or 3 inches square. They have no areola. The bullæ develop in successive crops for six or seven days, as a rule. The skin of all parts of the body is affected, rarely the mucous membranes. In one of the two cases reported, the blebs formed upon the conjunctiva. Cohen has described one case of this kind occurring in 50,000 eye cases. The duration of an attack is three or four weeks, or it may last months.

When this disease develops in the new-born, or shortly after birth, it is designated *pemphigus neonatorum*.

Diagnosis is from *varicella*, *dermatitis herpetiformis*, *impetigo* and *erythema multiforme*.

The latter is much more acute, the lesions more limited, and there is an erythematous base.

Prognosis.—These cases may result fatally, especially if they run a chronic course, when the system becomes much depleted. Hemorrhagic extravasation in the bullæ is an unfavorable occurrence.

Treatment.—The bullæ should be punctured, under aseptic precautions, and the loose skin removed. Mild antiseptic applications should be made to the raw surface below; 5 per cent boracic acid ointment or 10 per cent ichthyol ointment. If the process is very extensive, the continuous bath treatment for several hours at a time is efficacious.

Internally, *arsenic* is of curative value. Fowler's solution in increasing doses, to the point of tolerance, is indicated. *Quinin* is also of benefit, in 2 to 5 grain doses, and *iron* in the stage of convalescence. Nourishing food is also of value, and the diet should be closely watched.

The following cases occurred in my service at a local institution, and it is through the courtesy of Dr. I. N. Bloom, dermatologist, that they are reported:

Boy, nine years old, in the institution four months. When three years old had a number of boils requiring incision. Vaccinated four weeks before, that they are reported:



Fig 100 —*Pemphigus vulgaris acuta*.

fore with mild infection of site, but this had entirely healed 10 days previously, and the scab was off. Admitted to the infirmary with a temperature of 101.6° F., with a severe chill after admission. The following morning there was a hyperemic blush on the left arm, extending from the point of vaccination to the tip of the shoulder. There was pain at this point during the night. At the upper border of this area there was a large bulla 2 by 4 inches, which contained about 2 drachms of a transparent fluid. His tongue was coated a dirty white and breath foul. By the next day a general bullous eruption had developed, 72 bullae being counted. All parts of the body were affected, but the chest and abdomen. The surface beneath the bullae was red and moist, having the appearance of a scald.

The mucous membrane of the mouth was involved in the same process.

The left arm became involved almost over its entire extent, the palm of the hand on this side also being involved. It was very painful before the development of the bullæ there.

Epistaxis occurred on the fourth and fifth days. On the fifth day blebs developed on the left conjunctivæ, with pain and photophobia. The scalp was involved on the seventh day by a number of bullæ.

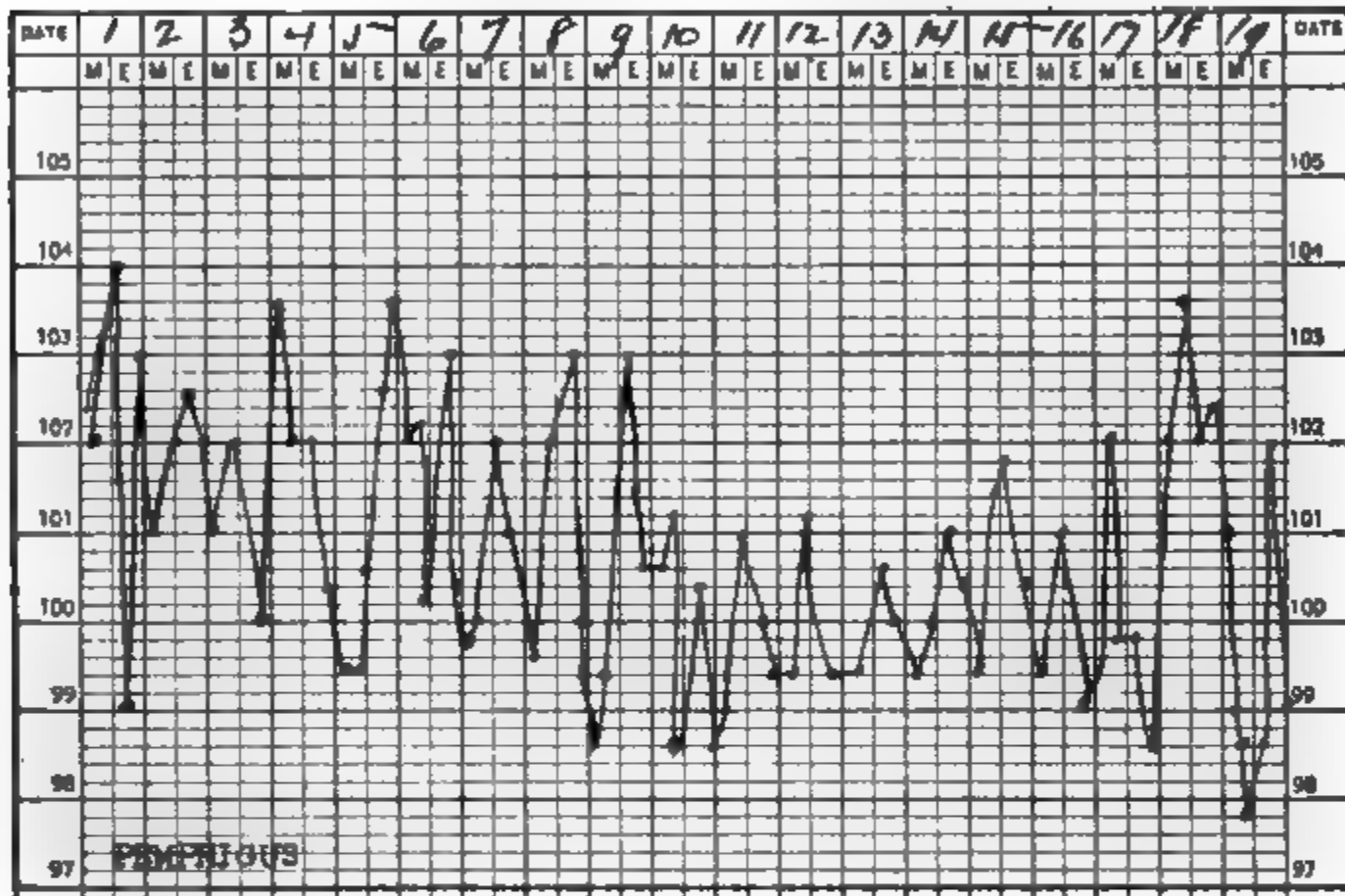


Fig. 101.—Pemphigus.

The temperature was fluctuating, rising before the development of each new crop of bullæ.

Recovery occurred in three weeks.

Girl, eight years old, rather poorly nourished, in Home seven weeks. Invasion marked by a chill. Temperature chart accompanies report. Elevation of temperature with each new crop of blebs. The largest bleb noticed was the result of coalescence of several, 3 x 3 inches, and held about 3 ounces of fluid. Blebs appeared without erythematous base, first on belly wall, and soon after on legs. The belly wall, genitals, legs, thighs, wrists and dorsal surfaces of hands were most affected. The upper arms and forearms were comparatively free. Scattered blebs on scalp, face, back, buttocks and palms of hands and soles of feet. One bleb developed on hard palate. The base beneath the blebs was red and moist and did not bleed. Appetite was good, bowels regular. Was apathetic except when lesions were dressed.

The disease lasted 23 days, with a slight relapse four weeks later.

Fowler's solution was given internally, tub baths for temperature; removal of raised epidermis over the blisters, and raw surfaces covered with gauze spread with 5 per cent boracic acid vaseline ointment, this dressing confined by a bandage.

ECZEMA.

This is one of the most important of the skin lesions of childhood, not only because of its prevalence but because of the variety of its manifestations and clinical types. Fully one-third of all skin diseases in children are eczema.

Etiology.—Much discussion has been indulged in as to the cause of this disease, with the subject still unsettled. Bateman says of this disease: "Eczema is a non-contagious eruption generally the effect of an irritant, whether externally or internally applied, but occasionally produced by a great variety of irritants in persons whose skin is constitutionally very irritable." The *constitutional* causes are most important, of which disorders of the *digestive system* are most frequent. Chronic constipation, catarrhal conditions of the gastrointestinal tract, toxemia from acute indigestion or intestinal putrefaction. *Rheumatic diathesis* and *anemia* are also given as causes. *Heredity* plays an important rôle. The part the *nervous system* plays in the etiology is not well known, but that there is a connection is generally recognized. *Dentition* may be associated with a distinct outbreak of eczema.

Among the *chemical* and *local* causes are *mustard*, *rhus*, *iodoform*, certain kinds of *soap*, *dyes*, *exposure to cold*, irritating effect of rough *clothing*, improperly washed napkins, etc.

Pathology.—A few changes are common to practically all clinical types of eczema; a dilatation of the blood vessels of the corium; an edema of the papillary layer; vesicles under the horny layer. Marked cellular infiltration occurs in the chronic form, and thickening of the skin.

Symptoms.—Clinically, certain changes are practically common to the several varieties. There is an erythematous appearance of the skin, with formation on this of minute vesicles. With this there is a sense of burning or itching. The pruritus is specially prominent. There is a tendency of the vesicles to rupture with the formation of a moist surface, or one which

is encrusted or scaly. The process is patchy in character and there is a tendency to frequent exacerbations and recurrences or relapses.

Eczema may be *acute*, *subacute* or *chronic*, and occur at any age. It is very frequent in childhood. Bulkley states that in 3000 cases of eczema 676 occurred under the age of five years, and 520 of these were under three years of age.

It has a special predilection for the face, in many instances beginning upon the face.

The following varieties of eczema may be recognized clinically: *Eczema erythematosum*, *papulosum*, *vesiculosum*, *pustulosum*, *squamosum*.

Eczema Erythematosum.—Occurs most frequently on the face, neck, hands and buttocks. As the name implies the first symptoms are erythematous spots which quickly coalesce. When about the eyes there is edema of both lids. The skin is thickened, and is hot and dry. Itching and burning are severe. Moisture may be present if there is much scratching. As the inflammation subsides the swelling decreases and the surface is covered by small, branny scales. This form may become chronic.

Eczema Papulosum.—This affects the back, arms, hands and legs most frequently. There is an eruption of dull red papules the size of a pin head, discrete or formed in small groups. These groups may coalesce and cover larger areas. The pruritus in this form is much greater than the others, and as a result of the scratching the tops of the papules are scraped off, leaving bleeding spots which become inflamed from infection. Recurrence of this form is frequent.

Eczema Vesiculosum.—This is the commonest form. The face, neck, hands and buttocks are oftenest affected. There are fine pin head size vesicles which develop on an erythematous base. Itching and burning precede the appearance of the vesicles. These vesicles coalesce as the fluid in the skin forms, rupture, and the coagulation of the fluid forms a crust over the surface. New vesicles form at the margins, and the same process is repeated.

The duration of the acute symptoms is about two weeks. If the crust is removed a moist, red base is uncovered.

Eczema Pustulosum.—If an infection of the vesicular form of eczema takes place, the pustular form will follow. The early signs are the same as in the vesicular type. The crusts are much thicker, and yellow or greenish in color. It is most often seen on the face and head. The early burning and itching may be present, but it is less marked after the pustules form.

Eczema Squamosum may be a primary condition or any of the types preceding may pass through the squamous or scaly stage before complete recovery. The skin is dry and covered with a fine scale. This is the *seborrheic* form, and occurs most often on the scalp of the child, often behind the ears and the eyebrows. When on the scalp it is the “milk crust” of the laity. A dirty yellow crust covers the scalp, and if it has been untreated sometimes is quite thick.

Prognosis.—Because of its proneness to recur, the prognosis as to a cure is not very favorable. The earlier treatment is begun the more chance for a prompt cure. Chronic cases respond slowly.

Treatment.—Attention to the general health of the child is indicated, its habits, food, bowels, kidneys, exercise, clothing, bathing, sleep, etc. Every detail of its life should be minutely ascertained as often a trivial cause will be found which is responsible for the condition.

Not many internal remedies have been found of service. Arsenic is of doubtful value. Wine of antimony in 5 minim doses has been recommended. Turpentine in small doses has been recommended by Crocker.

The child should not be allowed to scratch the inflamed area. This can be prevented by pinning the hands down to its dress, a rather unnatural method; by tying them in small cotton flannel bags, or special metal hand coverings, and by having the child wear a mask made of thin muslin, with eyes, mouth and nose uncovered. Soap and water should be kept off the affected areas entirely. No local remedy will be of avail if an attempt is made to apply it through the crusts. The crusts must be softened by the application of olive oil or soda solution and removed by a forceps.

Among the indications present are applications of soothing

remedies in the acutely inflamed cases, when the vesicles form, applying astringent remedies. Locally, a large number of remedies have been suggested, evidence sufficient to decide that none is effective in all cases. *Lotions, ointments and powders* are the forms in which remedies are applied externally.

In the *acute* form of eczema with burning and itching, any bland application is of benefit as lead and opium wash; biborate of soda solution, $\mathfrak{z}\text{i}$ to Oi , sopped or poured on several times a day. In the vesicular form, dusting powders are helpful; talcum, starch, magnesium carbonate, stearate of zinc, etc. Lassar's paste is of benefit as a bland and unirritating application.

The following applications are recommended:

R	Tinct. picis liquidæ	$\mathfrak{z}\text{i}$
	Acidi phenici	gr. xl
	Glycerine	$\mathfrak{z}\text{iss}$
	Zinci oxidi	$\mathfrak{z}\text{ii}$
	Ext. hamamelis dest.	$\mathfrak{z}\text{i}$.
	q.s. ad	$\mathfrak{z}\text{vi}$
M.		(Schamberg.)

R	Zinci oxidi	
	Amyli	$\mathfrak{z}\text{ii}$
	Vaseline	$\mathfrak{z}\text{ss}$
M. ft. paste.		

R	Zinci oxidi	$\mathfrak{z}\text{ss}$
	Pulv. calamine prep.	$\mathfrak{z}\text{iv}$.
	Glycerine	$\mathfrak{z}\text{i}$
	Aq. calcis	$\mathfrak{z}\text{viii}$
M.		(Startin.)

In the chronic form several drugs are of value, viz., tar, resorcin, salicylic acid, gelatin, chrysarobin, sulphur, ichthyol, silver nitrate, diachylon ointment, oil of cade, etc., and can be combined in many formulæ.

HERPES.

Synonyms.—*Fever blister. Cold sore.*

Definition.—A collection of vesicles upon the skin upon a common reddened base. They may occur upon the face, *herpes*

facialis; upon the lips, *herpes labialis*; upon the genitals, *herpes genitalis*; upon the body, *herpes zoster*.

Symptoms.—This eruption may occur independently or in connection with various febrile disorders, as pneumonia, tonsillitis, acute “colds,” cerebrospinal meningitis, etc.

The first symptom is a sense of burning and swelling, followed by a reddened base, and shortly by the crop of small vesicles, pin head in size or larger. The vesicles may rupture and form crusts. Successive crops may develop for several days, and there is a tendency for them to recur.

Diagnosis.—From *eczema* and *impetigo*. The latter, with great rarity, occur in single patches.

Treatment.—No special treatment is required. The digestion must be watched, the diet regulated and the bowels put in good condition. In recurrent cases, arsenic is of value. Locally, when the first symptom is noticed, the application of camphor or tincture of myrrh is of service; as soon as the vesicles have ruptured, dry calomel applied will be of service, or an ointment of calomel and vaseline, gr. x to ʒi, or 5 per cent boracic acid ointment.

HERPES ZOSTER.

Synonym.—*Shingles*.

Definition.—An acute inflammatory condition of the skin characterized by the formation of vesicles, distributed along the course of the cutaneous nerves, and accompanied by neuralgic pains. A comparatively rare condition in young children.

Etiology.—Season plays a part in etiology, it occurring more frequently in winter and spring. Exposure to cold is also a cause. There seems to be an intimate relationship between the lesion in the skin and the change in the nerve trunk, possibly an interstitial neuritis of the peripheral nerves, or of the sensory ganglia of the posterior nerve roots.

Symptoms.—After a brief period in which sharp, burning neuralgic pains are felt over the region affected, successive crops of vesicles appear, following the course of the nerve involved. Papules and macules precede the vesicular stage a very short time. As a rule but one side is affected at a time.

The most frequent parts affected are the areas supplied by the intercostal and trifacial nerves. Some fever may attend the formation of the vesicles.

Diagnosis.—Any vesicular eruption occurring upon one side of the body, and following fairly accurately the course of a peripheral nerve is difficult to mistake for any other disease.

Treatment.—Protection of the eruption from injury or infection is the first indication. It may be painted with tincture of benzoin, or an ichthyol collodion dressing, $\mathfrak{z}\text{i}$ to $\mathfrak{z}\text{i}$, or an ichthyol ointment can be used.

Internally sedatives may be necessary for the pain, heroin or codeine.

Quinin and arsenic are useful through the course of the disease.

The application of the galvanic current is most beneficial.

PRURITUS.

In this condition there is no special pathology except that produced by the irritation due to scratching. Itching, however, is a prominent symptom of a number of the skin diseases of children; *urticaria*, *scabies*, *eczema*, *sudamina*, *pediculosis*, etc. It also occurs at the anus, *pruritus ani*, as a result of intestinal worms.

An itching of the skin is evidenced by restlessness in the very young, disturbed sleep, and rubbing with hands and feet. The itching is usually intensified when the child is undressed, caused by the air striking the skin. As a result of the scratching the skin may become infected and an impetigo result. Much infiltration of the skin results from long-continued scratching.

An underlying general or systemic condition may be the cause of the condition acting through the nervous system, especially the cutaneous nerves.

Treatment.—If possible, the diagnosis must be made giving appropriate treatment to the cause found. Internally, tonics and nerve sedatives are of value; locally, the antipruritic remedies afford temporary relief. Bathing in a strong solution of bicarbonate of soda, or a solution of starch, allowed to dry on the skin, and ointments containing any of the following, or a

combination of them, will prove effective; camphor, menthol, chloral, acid carbolie, liquor potassæ, thymol, etc.

URTICARIA.

Synonyms.—*Nettle rash, hives, lichen urticatus.*

A number of varieties may occur, *urticaria factitia, urticaria papulosa* (lichen urticatus), *urticaria tuberosa, urticaria hemorrhagica, urticaria bullosa.*

Etiology.—This is generally considered as a cutaneous manifestation of a gastrointestinal disorder with a resulting toxemia, and either food or drugs may cause the same conditions. One family under my observation is peculiarly susceptible to quinin, it producing a general urticaria in four members; one cannot eat ripe fruit, berries or peaches without a severe case of urticaria, etc. The antitoxic sera, before their purification and elimination of the globulins from them, frequently caused both a local and general urticarial rash.

Pathology.—The process is most likely an angioneurosis. The process, as outlined, may be papular, vesicular or bullous in character.

Symptoms.—The eruption appears suddenly and without warning, the most common variety appearing as raised papules or wheals of various sizes, with whitish tops and a red base. These are accompanied by a sense of burning and severe itching. They may be localized or the whole body may be affected. In the *urticaria factitia*, letters can be traced on the skin, and they will stand out in bold relief in a few minutes. The name *dermographism* has been given to this phenomenon.

The form in which large wheals appear is usually of short duration, the fine papular form may last a number of weeks.

Prognosis.—The chronic form of urticaria is very unpromising, and fortunately is comparatively rare in children. The acute form is quickly recovered from, but has a tendency to recur.

Treatment.—In the acute cases, a brisk purgative is of benefit, and careful regulation of the diet will assist in the cure and prevent a recurrence. Inquiry as to special articles of diet should be made, in an effort to trace the direct cause of dis-

agreement. Milk of magnesia is a good remedy to correct the acidity as well as for its laxative effect.

Locally, the application of a hot bicarbonate of soda solution or a general bath containing the soda, is of benefit. The following lotion is recommended by Schamberg:

R	Menthol.	gr. xxx
	Acidi phenici	f3i
	Tinct. picis mineralis	3i-ii
	Ext. hamamelis dest.	3i
	Zinci oxidi	3ii
	Glycerini	3ii
	Spt. vini rect.	3ii
	Aquæ camphoræ	3ii
	Aquæ dest.	q.s. ad 3viii
M.		

PSORIASIS.

This is not an uncommon condition in childhood. It is evidenced by irregular patches with sharp cut edges, the center covered with whitish scales. They are found most often on the extensor surfaces of the extremities, later perhaps, on the forehead, scalp, and trunk.

This condition has a tendency to disappear during the summer months, recurring in winter. It is rather intractable to treatment. Removal of the scales, application of a 2 per cent ointment of chrysarobin will prove of benefit.

APPENDIX.

MILK MODIFICATIONS.

Mathematical equations are the basis of the majority of methods for the modification of milk, and one of these should be selected by the physician, memorized and used.

The following are some of the most practical which have been suggested.

BANER'S METHOD.

The method devised by Baner is probably the most useful and practical; it is as follows: Determine the quantity to be fed in 24 hours and the percentage of the ingredients, and use the following formula:

Q = quantity in 24 hours; C = cream in ounces. (In the following equation if a 20 per cent cream is used, 16 will be the divisor; if a 16 per cent cream is used, 12 will be the divisor; and if a 12 per cent cream is used, 8 will be the divisor.)
M = whole milk in ounces; F = percentage of fat in the mixture; P = the proteids, and L (lactose) = dry sugar of milk in ounces:

$$C = \frac{Q \times (F - P)}{8} \text{ (if 12 per cent cream is used.)}$$

$$M = \frac{Q \times P}{4} - C \text{ (i.e., the proteids in cow's milk.)}$$

$$W = Q - (C + M).$$

$$L = \frac{(L - P) \times Q}{100} \text{ (result being in ounces).}$$

Let 20 ounces be the quantity to be fed in 24 hours (10 feed-

ings of 2 ounces each) and the formula be: Fat, 2 per cent; sugar, 6 per cent; proteids, 1 per cent; the equation will be as follows:

$$C = \frac{20 \times (2 - 1)}{8} = \frac{20}{8} = 2\frac{1}{2} \text{ oz.}$$

$$M = \frac{20 \times 1}{4} - 2\frac{1}{2} = 5 - 2\frac{1}{2} = 2\frac{1}{2} \text{ oz.}$$

$$W = 20 - (2\frac{1}{2} + 2\frac{1}{2}) = 20 - 5 = 15 \text{ oz.}$$

$$M. S. = \frac{(6 - 1) \times 20}{100} = \frac{5 \times 20}{100} = \frac{100}{100} = 1 \text{ oz.}$$

Ordinary gravity cream contains 16 per cent of butter fat, and if 2 parts of this are added to 1 part of milk (containing 4 per cent fat), 12 per cent cream will be obtained.

Westcott has also devised mathematical formulæ for calculating milk mixtures as follows:

C = cream in ounces; M = whole milk in ounces; F = fat; P = proteids; L = lactose, sugar of milk, dry in ounces; Q = total quantity; S = sugar percentage:

$$C = \frac{(F - P) Q}{8.2 \text{ (12 p. c. cream) or } 12.4 \text{ (16 p. c. cream) or } 16.8 \text{ (20 p. c. cream)}}$$

$$M = \frac{Q F}{4} - 3C \text{ (12 p. c.) or } 4C \text{ (16 p. c.) or } 5C \text{ (20 p. c.)}$$

$$L = \frac{Q S - 4.3 (M + C)}{100}$$

If a 20 ounce mixture is desired, containing 3 per cent of fat, 6 per cent of sugar, and 2 per cent of proteids, using 16 per cent cream, the formula would read:

$$C = \frac{(3 - 2) 20}{12.4} = \frac{20}{12.4} = 1.6 \text{ oz.}$$

$$M = \frac{20 \times 3}{4} - (4 \times 1.6) = 15 - 6.4 = 8.6 \text{ oz.}$$

$$L = \frac{20 \times 6 - 4.3 (8.6 + 1.6)}{100} = \frac{120 - 43.9}{100} = 0.76 \text{ oz.} \Rightarrow \frac{3}{4} \text{ oz.}$$

Conversely, in order to determine the percentage of ingredients in any combination of cream, milk and sugar, Westcott suggests the following:

To find the percentage of fat:

$$\frac{C}{Q} \times 16 \text{ (or 12)} = \text{fat percentage from cream.}$$

$$\frac{M}{Q} \times 4 = \text{fat percentage from milk.}$$

Sum of these = fat percentage in mixture.

To find the percentage of proteids:

$$\frac{C}{Q} \times 3.6 \text{ (16 p. c.) or } 3.8 \text{ (12 p. c.)} = \text{proteid percentage from cream.}$$

$$\frac{M}{Q} \times 4 = \text{proteid percentage from milk.}$$

Sum of these = proteid percentage in mixture.

$$\text{Sugar percentage} = \frac{100L + 4.3 (M + C)}{Q}$$

An illustration: Take the above mixture, 1.6 ounces of 16 per cent cream, 8.6 ounces of milk, $\frac{3}{4}$ ounce of lactose, and $19\frac{1}{2}$ ounces of water:

$$\frac{1.6}{20} \times 16 = 1.28 \text{ per cent fat from cream.}$$

$$\frac{8.6}{20} \times 4 = 1.72 \text{ per cent fat from milk.}$$

$$1.28 + 1.72 = 3.0 \text{ total per cent fat in mixture.}$$

$$\frac{1.6}{20} \times 3.6 = 0.28 \text{ proteid per cent from cream.}$$

$$\frac{8.6}{20} \times 4 = 1.72 \text{ proteid per cent from milk.}$$

$$0.28 + 1.72 = 2.00 \text{ total proteids in mixture.}$$

$$\frac{100 \times 0.76 + 4.3 \times 10.2}{20} = \frac{76 + 43.9}{20} = 6 \text{ per cent sugar.}$$

Wescott has also devised a scale on cardboard discs which show the amount of each ingredient to use.

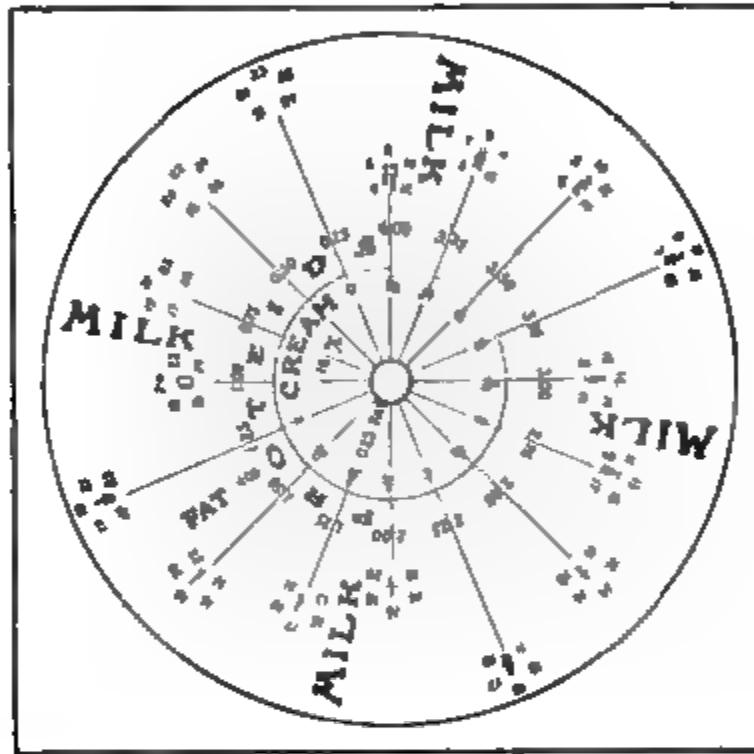


Fig. 102.—Westcott's milk modification chart.

Hamilton's method is based on the fact that cream, milk and skimmed milk contain relatively the same amount of proteids and salts:

Multiply quantity of the mixture by the percentage of fat desired and divide by the percentage of cream used, the quotient equals the amount of cream.

Multiply the quantity of milk mixture by the percentage of proteids desired, and divide by 4, the percentage of proteids in skimmed milk; subtract from this the amount of cream to be used, the result equals the amount of skimmed milk.

The quantity of cream and skimmed milk subtracted from

the total quantity gives the amount of diluent. Three drachms of lactose must be added to each 10 ounces of the mixture.

Example.—Forty ounces of mixture desired, of the following formula: Fat, 4; sugar, 7; proteids, 2; 16 per cent cream.

- $40 \div 4 \div 16 = 10$ ounces of 16 per cent cream.
- $40 \div 2 \div 4 = 20 - 10 = 10$ ounces of skimmed milk.
- $40 - 20 = 20$ ounces of diluent.
- Sugar = 4 level tablespoonfuls.
- Lime water, q. s.

CONNOR'S TABLE.

The following is Connor's table for milk modification:

PROPORTION OF MILK IN PREPARED MIXTURE.		PER CENT FAT										PER CENT PROTEIDS.	PER CENT SUGAR.
		Parts milk	Parts Diluent	Skimmed milk; fat, about 1 per cent.	Good whole milk, fat, about 4 per cent.	Top, 20 ozs., fat, 6 per cent (14 times whole milk.)	Top, 15 ozs.; fat, 8 per cent (2 times whole milk)	Top, 11 ozs.; fat, 10 per cent (2½ times whole milk.)	Top, 9 ozs.; fat, 12 per cent (3 times whole milk.)	Top, 8 ozs.; fat, 14 per cent (3½ times whole milk.)	Top 7 ozs.; fat, 16 per cent (4 times whole milk.)	For skimmed, whole, or top milk, 3.25 per cent	For skimmed, whole or top milk, 4 per cent.
1	1	1	1	0.13	0.50	0.75	1.00	1.25	1.50	1.75	2.00	0.41	0.50
1	1	1	6	0.14	0.57	0.86	1.14	1.43	1.71	2.00	2.30	0.46	0.57
1	1	1	3	0.17	0.67	1.00	1.33	1.67	2.00	2.34	2.67	0.54	0.67
1	1	1	4	0.20	0.80	1.20	1.60	2.00	2.40	2.80	3.20	0.65	0.80
1	1	1	3	0.25	1.00	1.50	2.00	2.50	3.00	3.50	4.00	0.81	1.00
1	1	1	2	0.33	1.33	2.00	2.67	3.33	4.00	4.66	5.33	1.08	1.33
2	1	2	3	0.40	1.60	2.40	3.20	4.00	4.80	5.60	6.40	1.30	1.60
1	1	1	1	0.50	2.00	3.00	4.00	5.00	6.00	7.00	8.00	1.63	2.00
5	1	5	3	0.62	2.50	3.75	5.00	6.25	7.50	8.75	10.00	2.03	2.50
12	1	12	1	0.67	2.67	4.00	5.33	6.67	8.00	9.33	10.67	2.16	2.67
3	1	3	1	0.75	3.00	4.50	6.00	7.50	9.00	10.50	12.00	2.44	3.00

MILK MODIFIERS.

Several modifiers of milk have been introduced, the Haas'

Materna, the Deming Modifier and Sloane Maternity Milk Set.

The Materna is a 16 ounce glass graduate with pouring tip. The outer surface is divided into seven panels. One of these shows the ounce graduation, the other six show as many formulæ, so arranged as to be suitable for the entire first year's feeding. Having determined on the formula desired, the respective ingredients are poured into the graduate to the line designated for the substance then inserted. First, the milk sugar is put in, then warm water or whatever diluent is deter-



Fig 103.—Hass' Materna.



Fig 104.—Deming Modifier.

mined upon, in which this is dissolved, the lime water, the cream and then the milk; the ingredients are then thoroughly stirred, and resultant mixture should analyze the same as the formula at the top of the panel used, 16 per cent or gravity cream and whole milk are used in the mixture. Enough bottles for the 24 hours are filled to the required amount, stopped with absorbent cotton, kept on ice, and each bottle warmed to blood heat when used. The following are the markings on the panels of the Materna:

1	2	3	4	5	6
Fat, 2% Proteids, 0.6% Sugar, 6% MILK	Fat, 2½% Proteids, 1% Sugar, 6% MILK	Fat, 3% Proteids, 1% Sugar, 6% MILK	Fat, 3½% Proteids, 1½% Sugar, 7% MILK	Fat, 4% Proteids, 2% Sugar, 7% MILK	Fat, 3½% Proteids, 2½% Sugar, 8½% MILK
Cream					
	Cream				
		Cream			
Lime-water	Lime-water				
		Lime-water	Cream		
Water	Water				
		Water			
			Lime-water	Cream	
			Water	Lime-water	
				Water	Cream
					Barley gruel
				Milk-sugar	
Milk-sugar	Milk-sugar	Milk-sugar	Milk-sugar		Gr. sugar
_____ X	_____ X	_____ X	_____ X	_____ X	

The Deming percentage milk modifier is a 16 ounce graduate, its graduations and percentages being based on whole and top milks containing 3.2 per cent proteids and 4 per cent, 7 per cent, 10 per cent and 12 per cent fat:

Directions.—Look in the column headed proteids for desired percentage of proteids. Then move to the right until the desired percentage of fat is found in line with the percentage

GRADUATIONS AND MARKINGS.

OUNCES.	PROTEIDS. Top line.	FAT			
		Use 4 p.c. milk or whole milk.	Use 7 p.c. milk or the top 16 oz. from one quart.	Use 10 p.c. milk or the top 11 oz. from one quart.	Use 12 p.c. milk or the top 9 oz. from one quart.
16	.....			
14	.....			
	<i>per cent.</i>	<i>per cent.</i>	<i>per cent.</i>	<i>per cent.</i>	<i>per cent.</i>
12	2.4	3.0	5.2	7.5	9.0
	2.2	2.7	4.8	6.8	8.2
10	2.0	2.5	4.4	6.2	7.5
	1.8	2.2	3.9	5.6	6.7
8	1.6	2.0	3.5	5.0	6.0
	1.4	1.7	3.0	4.3	5.2
6	1.2	1.5	2.6	3.7	4.5
	1.0	1.2	2.2	3.1	3.7
4	.80	1.0	1.7	2.5	3.0
	.60	.75	1.3	1.8	2.2
2	.40	.50	.88	1.3	1.5
1	.20	.25	.44	.62	.75

of proteids. Now look at the head of this fat column to find what strength of milk to use. Pour this milk into the modifier up to the desired percentage of proteids and add gruel or water to "top line." This will make 16 ounces.

The percentage of sugar in the mixture will be almost exactly the same as the percentage of proteids:

- 1 level tablespoonful of granulated sugar adds 2½%.
- 2 level tablespoonfuls of granulated sugar add 5 %.
- 1½ level tablespoonfuls of milk sugar add 2½%.
- 3 level tablespoonfuls of milk sugar add 5 %.

Slide a knife over the bowl of the spoon to make it level full.

Example.—To make a mixture 3 per cent fat, 6 per cent sugar and 1 per cent proteids, look in the proteid column for 1 per cent. At the right of this will be found 3.1 per cent in the third column of fat percentages, which is headed: "Use 10 per cent milk or the top 11 ozs. from 1 qt." Obtain 1 quart of good, fresh milk, and when the cream shows plainly dip off the top 11 ounces into a pitcher or bowl, and stir to mix. The first dipperful will have to be removed with a teaspoon or the bottle will overflow when the dipper is inserted. Pour this milk into the modifier up to the 1 per cent proteids line. Then fill with gruel or water to "top line." Add 5 per cent sugar—

2 level tablespoonfuls of granulated sugar or 3 of milk sugar—and stir to dissolve the sugar. To add 5 per cent or 10 per cent of lime water to the mixture, leave out 1 ounce of gruel or water for 5 per cent or 2 ounces for 10 per cent, and replace with lime water.

After the cream has risen on a quart of 4 per cent milk, there may be dipped from the top 7 ounces, 16 per cent fat; 8 ounces, 14 per cent; 9 ounces, 12 per cent; 10 ounces, 11 per cent; 11 ounces, 10 per cent; 13 ounces, 9 per cent; 15 ounces, 8 per cent; 16 ounces, 7 per cent; 20 ounces, 6 per cent; 24 ounces, 5 per cent; for 4 per cent milk or whole milk shake the bottle to mix the cream and milk; to obtain fat-free milk dip off the cream and use the remaining milk.

As the modifier is marked, 50 combinations of fat under 4 per cent may be had with proteids below 2 per cent, and 36 with proteids below 1 per cent. But by using the above-mentioned milks 12 different percentages of fat may be had with each percentage of proteids. When half graduations are used proteids may be varied by .10 per cent, and fat by .12 per cent, .15 per cent, .19 per cent, .22 per cent, .25 per cent, .31 per cent, .35 per cent, .38 per cent, .44 per cent or .50 per cent, at a time, giving over 200 hundred combinations of fats and proteids.

The Sloane Modifier, Cragin's method, consists of a glass holding 20 ounces, and Chapin's Cream Dipper, holding 1 fluid ounce. The following directions are given for the use of this modifier:

From the upper part of a quart bottle which has stood four hours are obtained two kinds of top milk:

Top Milk No. 1.—Obtained by taking 10 dipperfuls from the top of the bottle, the first dipper being filled with a spoon to prevent spilling, the remaining 9 dipperfuls being taken by dipping carefully from the bottle. These 10 dipperfuls are to be mixed in a clean pitcher, and from the milk thus mixed the baby's food may be prepared until it is from four to six months old.

Top Milk No. 2.—Obtained by taking 16 dipperfuls from the top of the bottle, the first dipper being filled as before with a

spoon, the remaining 15 dipperfuls being taken by dipping carefully from the bottle.

These 16 dipperfuls are to be mixed in a clean pitcher, and from the milk thus mixed the baby's food may be prepared from the age of about four months until it is a year old.

In using this milk set, whatever strength of food is desired, the sugar and the lime water are always the same: 1 ounce of milk sugar (or $\frac{1}{2}$ ounce of granulated sugar) and 1 ounce (1 dipperful) of lime water.

The quantity of food made by filling the glass once is always the same—20 ounces. The strength of the food varies with the number of dipperfuls of top milk used.

Preparation of the Food.—First, into the measuring glass pour milk sugar up to the line marked 1 ounce milk sugar, or granulated sugar up to the line marked one-half ounce granulated sugar.

Second.—Add 1 dipperful of lime water and mix by shaking the glass.

Third.—Add the required number of dipperfuls of top milk, according to the age of the baby, as explained below.

Fourth.—Fill the measuring glass up to the line marked 20 ounces of food with water, either plain or barley water or oatmeal water.

Age of infant.	Interval in hours.	No. of feed- ings in 24 hours.	No. of night feedings.	Amount ounces at each feeding.	Total amount ounces in 24 hours.
1 week	2	10	1	1	10
2 weeks	2	10	1	$1\frac{1}{2}$	15
4 weeks	2	9	1	$2\frac{1}{2}$	$22\frac{1}{2}$
6 weeks	$2\frac{1}{2}$	8	1	3	24
8 weeks	$2\frac{1}{2}$	8	1	$3\frac{1}{2}$	26
3 months	$2\frac{1}{2}$	7	0	4	28
4 months	$2\frac{1}{2}$	7	0	$4\frac{1}{2}$	$31\frac{1}{2}$
5 months	3	6	0	$5\frac{1}{2}$	33
6 months	3	6	0	$5\frac{3}{4}$	$34\frac{1}{2}$
7 months	3	6	0	$6\frac{1}{4}$	$37\frac{1}{2}$
8 months	3	6	0	7	42
9 months	3	6	0	7	42
10 months	3	5	0	$8\frac{1}{2}$	$42\frac{1}{2}$
11 months	3	5	0	$8\frac{3}{4}$	$43\frac{1}{2}$
12 months	3	5	0	9	45

Formula on which the Average Healthy Baby may be started:

Premature	No. 1 or 2
2-4 weeks	No. 5, 8, 9, or 11
1-2 months	No. 12 or 13
2-4 months	No. 19 or 20
4-6 months	No. 24 or 25
6-8 months	No. 26 or 27
8-9 months	No. 28

TABLE FOR ESTIMATION OF FAT PERCENTAGES IN CREAMS.

One quart of whole milk, of 4 per cent fat, will yield on an average approximately:

Cream.....	10 per cent in the upper	8 oz. after 6 hours.
Cream.....	10 per cent in the upper	11 oz. after 8 to 12 hours.
Cream.....	12 per cent in the upper	8 oz. after 8 hours.
Cream.....	16 per cent in the upper	6 oz. after 8 hours.
Cream.....	20 per cent in the upper	4 oz. after 4 to 6 hours.

WHEY CREAM MIXTURES.

Whey cream mixtures may be obtained by using whey as a diluent, in place of the boiling water, preferably in the combinations containing low proteid percentages. Each 2 ounces of whey replacing an equal quantity of water in a twenty-ounce mixture, will raise the whey proteid percentage 0.10, and will increase the sugar percentage 0.50. The total sugar percentage is, therefore, the amount contributed by the cream and fat-free milk, which is indicated in the last column of the table on the reverse of the card, plus that of the whey. The amount of dry sugar which must be added to make the desired final sugar percentage can be easily calculated by reference to the following table:

- 1 measure of dry lactose in a 20-oz. mixture gives 2.00 per cent of sugar.
 - $\frac{1}{2}$ measure of dry lactose in a 20-oz. mixture gives 1.00 per cent of sugar.
 - $\frac{1}{4}$ measure of dry lactose in a 20-oz. mixture gives 0.50 per cent of sugar.
- (One measure is approximately one level tablespoonful.)

EXAMPLE—If in formula 21 fourteen ounces of whey are added in place of the same quantity of water, the whey proteids are increased 0.70 per cent, making total proteids of 1.30 per cent. The sugar contributed by the cream is 0.78, by the whey 3.50, making a total of 4.28. The desired percentage of sugar is 6, therefore the balance of 1.72 per cent may be obtained by adding a little short of one measure of sugar.

Whey should be made of fat-free milk, and should be heated to 150° F. (65° C.) before it is added to the cream mixture, to destroy the rennet enzyme. One quart of fat-free milk will yield about 24 ounces of whey.

During the first month it is usually better to use plain water, after that barley water, or if the baby is very constipated, oat-meal water.

MODIFICATION OF MILK—LADD'S TABLE

No.	TWENTY-OUNCE MIXTURES, PERCENTAGE OF				OUNCES OF CREAM				OUNCES OF FAT-FREE MILK USED WITH CREAMS OF				OUNCES OF		Milk-sugar measure	Sugar percentage with out dry sugar
	Fat.	Sugar	Proteids	Alkalinity	10 p.c.	12 p.c.	16 p.c.	20 p.c.	10 p.c.	12 p.c.	16 p.c.	20 p.c.	Lime-water	Boiled water		
1	1.50	4.50	0.25	0.00	*	*	*	1	*	*	*	0	1	17½	2	0.88
2	1.50	4.50	0.50	0.00	*	*	*	1	*	*	*	0	1	16	2	0.61
3	2.00	5.00	0.25	0.00	*	*	*	2	*	*	*	0	1	17	2	0.75
4	2.00	5.00	0.50	0.00	*	*	*	2	*	*	*	0	1	15	2	0.73
5	2.00	5.00	0.75	0.00	*	*	*	2	*	*	*	0	1	14	2	1.01
6	2.00	5.50	1.00	0.00	*	*	*	2	*	*	*	0	1	13	2	1.30
7	2.50	6.00	0.60	0.00	*	*	*	2	*	*	*	0	1	15	2	0.73
8	2.55	6.00	0.75	0.00	*	*	*	2	*	*	*	0	1	14	2	1.01
9	2.50	6.00	1.00	0.00	*	*	*	2	*	*	*	0	1	13	2	1.28
10	3.00	6.00	0.60	0.00	*	*	*	3	*	*	*	0	1	15	2	0.84
11	3.00	6.00	0.75	0.00	*	*	*	3	*	*	*	0	1	14	2	1.12
12	3.00	6.00	1.00	0.00	*	*	*	3	*	*	*	0	1	13	2	1.35
13	3.00	6.00	1.25	0.00	*	*	*	3	*	*	*	0	1	11	2	1.35
14	3.00	6.50	1.50	0.00	*	*	*	3	*	*	*	0	1	10	2	1.91
15	3.00	6.50	2.00	0.00	*	*	*	3	*	*	*	0	1	7	2	2.88
16	3.50	6.00	0.50	0.00	*	*	*	3	*	*	*	0	1	15	2	0.79
17	3.50	6.00	0.75	0.00	*	*	*	3	*	*	*	0	1	14	2	1.01
18	3.50	6.50	1.00	0.00	*	*	*	3	*	*	*	0	1	13	2	1.20
19	3.50	6.50	1.25	0.00	*	*	*	3	*	*	*	0	1	11	2	1.68
20	3.50	6.50	1.50	0.00	*	*	*	3	*	*	*	0	1	10	2	2.03
21	4.00	6.00	0.60	0.00	*	*	*	4	*	*	*	0	1	15	2	0.79
22	4.00	6.00	0.75	0.00	*	*	*	4	*	*	*	0	1	14	2	1.13
23	4.00	7.00	1.00	0.00	*	*	*	4	*	*	*	0	1	13	2	1.35
24	4.00	7.00	1.25	0.00	*	*	*	4	*	*	*	0	1	11	2	1.68
25	4.00	7.00	1.50	0.00	*	*	*	4	*	*	*	0	1	10	2	2.02
26	4.00	7.00	2.00	0.00	*	*	*	4	*	*	*	0	1	7	2	2.58
27	4.00	7.00	2.50	0.00	*	*	*	4	*	*	*	0	1	4	2	3.20
28	4.00	7.00	3.00	0.00	*	*	*	4	*	*	*	0	1	1	2	3.86
29	4.00	8.00	3.00	0.00	*	*	*	4	*	*	*	0	1	1	1	3.88
30	4.00	5.50	3.00	0.00	*	*	*	4	*	*	*	0	1	1	1	3.88

* Combination impossible with percentages of cream indicated.

For 25 ounce mixtures multiply the amount of each ingredient by 1½.

For 30-ounce mixtures multiply the amount of each ingredient by 1½.

For 35-ounce mixtures multiply the amount of each ingredient by 1½.

For 40-ounce mixtures multiply the amount of each ingredient by 2.

For 45-ounce mixtures multiply the amount of each ingredient by 2½.

Strength of the Food for Different Months.—First Day.
Give no milk; put in milk sugar to mark, then fill with boiled water.

Second Day.—Add 1 dipperful of top milk No. 1.

Third Day.—Add 2 dipperfuls of top milk No. 1.

Fourth Day.—Add 3 dipperfuls of top milk No. 1.

Fifth to Tenth Day.—Add 4 dipperfuls of top milk No. 1.

Tenth to Thirtieth Day.—Add 5 dipperfuls of top milk No. 1.

One Month to Two Months.—Add 6 dipperfuls of top milk No. 1.

Two Months to Four Months.—Add 7 dipperfuls of top milk No. 1.

Four Months to Nine Months.—Add 10 dipperfuls of top milk No. 2.

When the baby needs more than 20 ounces in the 24 hours, fill the measuring glass twice instead of once, before putting the food into the baby's bottle.

After nine months the food is prepared by shaking the quart bottle of milk when first obtained and using the plain mixed milk.

HALE'S METHOD.

Hale¹ suggests the following method of modifications:

Rule 1.—To find the percentage of fat (or sugar or proteid) in any mixture multiply the number of ounces used of each fat (or sugar or proteid) containing factor by the percentage of fat (or sugar or proteid) it contains, and divide the sum of fat (or sugar or proteid) results by the number of ounces in the whole mixture.

Example.—A mixture is made up of

2 ounces of 10 per cent cream,
10 ounces of whole milk,
 $\frac{2}{3}$ ounce of lactose,
8 ounces of water,

—
20 ounces in all, and we apply the rule.

Fat from cream, 2 ounces multiplied by 10 per cent equals..20 parts of fat

Fat from milk, 10 ounces multiplied by 4 per cent equals..40 parts of fat

—
60 parts. The
sum of fat re-
sults.

¹ Archives of Pediatrics, May, 1908.

Sugar from cream, 2 ounces multiplied by 4.50 per cent	
equals	9 parts of sugar
Sugar from milk, 10 ounces multiplied by 4.50 per cent	
equals	45 parts of sugar
Sugar from lactose, 0.66 ounce multiplied by 100 per cent	
equals	66 parts of sugar
	<hr/>
	120 parts. The sum of sugar results.

Proteids from cream, 20 ounces multiplied by 3.50 per cent	
equals	7 parts of proteids
Proteids from milk, 10 ounces multiplied by 3.50 per cent	
equals	35 parts of proteids
	<hr/>
	42 parts. The sum of proteid results.

These sums divided by 20, the number of ounces in the mixture, will give the percentages desired, thus:

20) 60 per cent fat,	120 per cent sugar,	42 per cent proteids.
<hr/>		
3 per cent fat,	6 per cent sugar,	2.1 per cent proteids.

These percentages represent the amount of fat, sugar and proteids the mixture contains, and with this knowledge we can intelligently appreciate the strength and proportion of the ingredients, and are prepared to reduce to grams, and then estimate the caloric values.¹

This example is given to make Rule 1 more clear. The following data is obtained from the mother:

In each bottle she puts

2 ounces of milk.
 1 ounce of cream.
 $\frac{1}{2}$ ounce of lime water.
 $2\frac{1}{2}$ ounces of water.
 1 heaping teaspoonful of lactose, equal to $\frac{1}{2}$ ounce.²

6 ounces.

¹ An ounce equals 29.5 grams. One gram of fat yields 9.3 calories. Proteids and sugar each yield 4.1 calories per gram.

² A Chapin ounce dipper, even full of milk-sugar, varies in weight from 245 grains to 280 grains Troy, with simple moderate juggling to settle it. When sugar

What she has told us so far means very little, and we must inquire further. This we do, discovering that the milk is skimmed milk, and that the cream is from the top 6 ounces of the bottle. Thus the milk used would run about .75 per cent fat, 4.150 per cent sugar, 3.50 per cent proteids, and the cream about 18 per cent fat, 4.50 per cent sugar, and 3.25 per cent proteids. Having learned these facts we proceed to apply Rule 1, first for fat, next for sugar, and last for the proteids.

The totals then are divided by

Milk	—2	oz. multiplied by	0.75 p.c. equals	1.50 parts of fat from the milk.
Cream	—1	oz. multiplied by	18.00 p.c. equals	18.00 parts of fat from the cream.

which gives us 19.50 parts of fat in all.

Milk	—2	oz. multiplied by	4.50 p.c. equals	9.00 parts of sugar from the milk.
Cream	—1	oz. multiplied by	4.50 p.c. equals	4.50 parts of sugar from the cream.
Lactose	—0.20	oz. multiplied by	100.00 p.c. equals	20.00 parts of sugar from the lactose.

which gives us 33.50 parts of sugar in all.

Milk	—2	oz. multiplied by	3.50 p.c. equals	7.00 parts of proteids from the milk.
Cream	—1	oz. multiplied by	3.25 p.c. equals	3.25 parts of proteids from the cream.

which gives us 10.25 parts of proteids in all.

The totals then are divided by

6) Fat, 19.50 parts.	Sugar, 33.50 parts.	Proteids, 10.25 parts.
3.25 p.c. fat.	5.58 p.c. sugar.	1.70 p.c. proteids.

Rule 2.—To find the number of ounces of any factor (be it cream, milk, etc., or sugar) that must be used to obtain any desired percentage of fat (or sugar or proteids), multiply the number of ounces in the whole mixture by the percentage of fat (or sugar or proteids) desired, and divide the result by the percentage in which the fat (or sugar or proteids) occurs.

Example.—We wish to make up a 30 ounce mixture, containing 2.50 per cent fat, using whole milk and water. Thirty ounces multiplied by 2.50 per cent equals 75; this divided by 4 per cent gives 18.75 ounces as the number needed to give the required amount of fat.

By way of further example, we will make up a thirty ounce mixture, containing 2.50 per cent of fat, 6 per cent of sugar, and

is loosened in its can, or carton, and dipped out, a heaping tablespoonful varies from 235 grains to 338 grains. The damper and more sticky the sugar the more will remain on the spoon, Mallinckrodt's and Merck's running heavier than Squibb's. A dipped and then struck tablespoonful runs from 140 grains to 172 grains. Here more of the sticky sugar pushes off than of the dry. A dipped heaping teaspoonful runs from 85 to 100 grains, averaging approximately 1 to 5 ounces. A dipped and then struck teaspoonful holds from 39 to 47 grains.

1.75 per cent of proteids. Here the problem is complicated by the fact that the fat and proteids must both be entirely derived from the milk. The first step is, therefore, to ascertain the relation which the fat and proteids bear to each other. To do this we divide the percentage of the proteids by the percentage of the fat; thus, 1.75 divided by 2.50 gives .7. Which means that the relation of proteids to fat is as 7 is to 10.

We now endeavor to find what portion of a bottle of milk has fat and proteids in this proportion, or approximately so. In looking back over the percentages of fat and proteids in different portions of a bottle, our eyes light upon the upper 25 ounces, which contain 5 per cent fat and 3.50 per cent proteids, exactly the thing we want. Having now found a milk with the fat and proteids in the proportions desired, we proceed at once to find the number of ounces necessary to give the required percentage of either the fat or proteids. It makes no difference which is chosen to work with, the proportion remains undisturbed. We will choose to work it out for the proteids. Applying Rule 2, we multiply 30 ounces by 1.75, which gives 52.50; this divided by 3.50 per cent gives 15 ounces as the number of ounces needed to supply both fat and proteids in the desired amounts. We notice that in this case the amount of milk happens to be half of the bulk prepared, consequently the dilution is one-half, which proves our calculation and tells us further that the sugar supplied by the milk is one-half of 4.50 per cent; that is, 2.25 per cent, making it unnecessary for us to work it out by Rule 1. There is, then, 2.25 per cent of sugar supplied; 3.75 per cent must still be added to make up the required 6 per cent. We apply Rule 2 and multiply 30 ounces by 3.75 per cent, which gives 112.50, and this divided by 100 per cent (the percentage of sugar in lactose) gives 1.125 ounces as the amount of lactose that must be used. This amounts to simply finding what 3.75 per cent of 30 ounces is, as we realize that 3.75 per cent should be written .0375.

The upper third contains three times as much fat as proteids; that is, in the ordinary bottled milk it contains about 10 per cent fat and a shade less than 3.50 per cent proteids. The

upper half contains twice as much fat as proteids; that is, 7 per cent fat and 3.50 per cent proteids.

In the use of 10 per cent milk it is very simple, for to obtain a certain percentage of fat in the 20 ounce mixture it is only necessary to multiply the desired percentage by 2 to find the amount of milk needed. This is clear when we look at it a little more closely. One ounce in 20 is evidently in the same proportion as 5 in 100; that is, 5 per cent. This 1 ounce is only $\frac{1}{10}$ fat, so the amount of fat it gives is $\frac{1}{10}$ of 5 per cent, which is .50 per cent, or $\frac{1}{2}$ per cent; that is, one-half the number of ounces used. For every 1 per cent of fat desired 2 ounces of such a milk must be used in each 20 ounce mixture.

The proteids are one-third fat; thus, 1 ounce of this 10 per cent milk yields scant .17 per cent proteids in a 20 ounce mixture.

The sugar is a little less than half the fat, or about .23 per cent in the 20 ounce mixture. As lactose is 100 per cent sugar, each ounce added increases the sugar just 5 per cent.

In using the upper half of the ordinary bottled milk, the calculations may be done as follows: This milk contains 7 per cent fat, 4.50 per cent sugar, and 3.50 per cent proteids; that is, the proteids are just half the fat, and the sugar is .64, or approximately two-thirds of the fat, and may be so considered. We have seen that 1 in 20 is 5 per cent. One ounce of milk, 7 per cent fat, in a 20 ounce mixture gives to the mixture that part of 5 per cent which 7 per cent is of 100 per cent, namely, $\frac{1}{14.3}$; $\frac{1}{14.3}$ of 5 per cent is .35 per cent; therefore, each ounce gives .35 per cent of fat, which is considered $\frac{1}{3}$ per cent. This enables us at a glance to tell how many ounces are needed to give any desired percentage, namely, three times as many ounces as per cent of fat wished.

The proteids in the mixture would be in the same proportion as in the milk used, namely, half the fat.

The sugar would also be in the same proportion as in the milk; that is, two-thirds as much as the fat.

Example.—We wish 3 per cent fat, and take 9 ounces from the upper half of a bottle. Applying Rule 1 as a test, the mixture is seen to contain 3.15 per cent fat, which is close enough.

We will now, by way of a more complete example, take a formula and work it out. We wish in every 24 hours to give a baby 33 ounces of a mixture containing 2.50 per cent fat, 7 per cent sugar, and 1.25 per cent proteids. In order to have a margin for waste and possible breaking of a nursing bottle, we will make up 40 ounces. This will require just twice what the 20 ounces do. To make up a 20 ounce mixture with 2.50 per cent fat, we take as many ounces of the 7 per cent milk as three times the percentage of fat desired. This gives 7.50 ounces as the number to be used. For 40 ounces twice as much is taken.

The sugar is two-thirds of the fat; that is, 1.66 per cent of sugar is supplied by the milk. We desire 7 per cent, so there is lacking 5.44 per cent; that is, 5 per cent, and approximately $\frac{1}{10}$ of 5 per cent more. One ounce of lactose gives the 5 per cent, and 1 drachm more is near enough to the $\frac{1}{10}$ desired. Thus, 1 ounce and 1 drachm will bring the sugar up to 7 per cent in the 20 ounce mixture, twice as much will be needed in the whole amount being mixed.

The proteids, because of their proportion, must be one-half the fat; that is, 1.25 per cent (or exactly 1.30 per cent), the percentage wished. The whole mixture will then be made as follows:

15 ounces upper half of bottle.
25 ounces water.
2½ ounces lactose.
—
40 ounces

MOFFITT'S METHOD OF CALCULATION.

Moffitt¹ recommends the following method of calculation of various formulæ; taking average herd milk to show the following analysis: fat 4 per cent, carbohydrates, 4.5 per cent, proteins, 3.5 per cent, and 16 per cent cream to show fat, 16 per cent, carbohydrates 4.05 per cent, proteins, 3.2 per cent.

Suppose *a* represent the per cent of fat, *b* the per cent of carbohydrates, and *c* the per cent of proteins in any artificial mixture; that is, that which is commonly known as, for ex-

¹ *Journal American Medical Association*, vol. lv, no. 22.

ample, a 3-6-1 mixture (3 per cent of fat, 6 per cent of carbohydrates, and 1 per cent of proteins) we term an *a-b-c* mixture. Now let *x* represent the per cent of milk, *y* the per cent of cream, and *z* the per cent of milk-sugar necessary to compound such a mixture. The diluent will then be equal to $100 - x - y$.

It is then obvious that

$$\frac{4x}{100} + \frac{16y}{100} = a \text{ or } x + 4y = 25a \dots\dots\dots (1)$$

$$\text{and } \frac{4.5x}{100} + \frac{4.05y}{100} + z = b \text{ or } 90x + 81y + 2,000z = 2,000b \dots\dots (2)$$

$$\text{also } \frac{3.5x}{100} + \frac{3.2y}{100} = c \text{ or } 35x + 32y = 1,000c.$$

By subtracting Equation 1 multiplied by 8 ($8x + 32y = 200a$) from Equation 3 we have

$$27x = 1,000c - 200a \text{ or } x = \frac{1,000c - 200a}{27}$$

By subtracting Equation 3 from Equation 1, multiplied by 35 ($35x + 140y = 875a$), we have

$$108y = 875a - 1,000c \text{ or } y = \frac{875a - 1,000c}{108}$$

By substituting these values of *x* and *y* in Equation 2 we have

$$\frac{90(1,000c - 200a)}{27} + \frac{81(875a - 1,000c)}{108} + 2,000z = 2,000b$$

$$\text{that is } 40,000c - 8,000a + 7.875a - 4,000c + 24,000z = 24,000b$$

$$\text{or } z = \frac{a + 192b - 248c}{192}$$

We then have the values of *x*, *y* and *z* in terms of *a*, *b* and *c*; that is to say, we have the per cent of milk, cream and milk-sugar necessary to make up an *a-b-c* mixture, and any values whatever (of fat, carbohydrate and protein percentages), such as 3, 6 and 1 may be substituted for *a*, *b* and *c*.

Our formula then is

$$\text{per cent of milk} = \frac{1,000c - 200a}{27} \dots\dots\dots (1)$$

$$\text{per cent of cream} = \frac{875a - 1,000c}{108} \dots\dots\dots (2)$$

$$\text{per cent of milk-sugar} = \frac{a + 192b - 248c}{192} \dots\dots\dots (3)$$

To demonstrate the accuracy of the calculation in devising this for-

mula, suppose we desire a 4-4.5-3.5 mixture, i.e., a mixture containing 4 per cent of proteins. It will be seen that this is cow's milk.

Substituting 3.5 for c and 4 for a in (1), we have

$$\frac{1,000 \times 3.5 - 200 \times 4}{27} = \frac{3,500.0 - 800}{27} = \frac{2,700}{27} = 100$$

Substituting likewise in (2), we have

$$\frac{875 \times 4 - 1,000 \times 3.5}{108} = \frac{3,500 - 3,500.0}{108} = 0$$

Substituting these values in (3), and also 4.5 for b, we have

$$\frac{4 + 192 \times 4.5 - 248 \times 3.5}{192} = \frac{4 + 864.0 - 868.0}{192} = 0$$

showing that, in compounding a 4-4.5-3.5 mixture, we take 100 parts milk, no cream, no sugar and no diluent.

Now suppose we desire a 16-4.05-3.2 mixture (cream).

Substituting 3.2 for c and 16 for a in (1), we have

$$\frac{1,000 \times 3.2 - 200 \times 16}{27} = \frac{3,200.0 - 3,200}{27} = 0$$

Substituting likewise in (2), we have

$$\frac{875 \times 16 - 1,000 \times 3.2}{108} = \frac{14,000 - 3,200.0}{108} = \frac{10,800}{108} = 100$$

Substituting these values in (3), and also 4.05 for b, we have

$$\frac{16 + 192 \times 4.05 - 248 \times 3.2}{192} = \frac{16 + 777.60 - 793.6}{192} = 0$$

showing that, in compounding a 16-4.05-3.2 mixture, we take 100 parts of cream, no milk, no sugar and no diluent.

In making a table of various mixtures from this formula, Moffitt carries the calculations to 0.1 per cent, i. e., to three decimal places, which has shown results within 0.04 per cent of perfect accuracy in all mixtures in which he has calculated the percentages of fat, carbohydrates and proteins from the amounts of milk, cream and sugar used in compounding such mixtures.

By the table from this formula 24 ounces of a 3-6-1 mixture require 3.5 ounces of milk, and 3.6 ounces of cream and 1.13 ounces of milk-sugar. Now 3.5 ounces of milk and 3.6 ounces of cream contain 0.716 ounce of fat, i. e., 2.98 per cent of 24 ounces (inaccurate by but 0.02 per cent) and 0.2377 ounce of proteins, i. e., 0.99 + per cent of 24 ounces (within 0.01 per cent

of absolute accuracy), and these amounts of milk and cream plus the added sugar total in all 1.4333 ounces of carbohydrates in the 24 ounce mixture of 5.97 + per cent (within 0.03 per cent).

In calculating the amounts of the ingredients in 24 ounces of a 3.25-6-1.25 mixture by the old formula we arrive at an even more inaccurate result in regard to the proteins, for $C = 4$ ounces, $M = 3.5$ ounces and $S = 1.14$ ounces, and in 24 ounces, 4 ounces of cream and 3.5 ounces of milk give 3.25 per cent fat (accurate) and 1.04 per cent of proteins (0.21 per cent out of the way), and these amounts of cream and milk with the added 1.14 ounces of milk-sugar give 6.08 per cent of carbohydrates (0.08 per cent off) practically a 3.25-6-1 mixture instead of a 3.25-6-1.25.

By this table 24 ounces of a 3.25-6-1.25 mixture require 5.328 ounces of milk, 3.528 ounces of cream and 1.056 ounces of milk-sugar, giving 3.24 per cent of fat, 5.97 per cent of carbohydrates and 1.24 per cent of proteins.

The greatest inaccuracy encountered in the old formula, and in our table as well, is the last mixture in the table, viz., 5-7-3.50. By the old formula in a 24-ounce mixture we have 3 ounces of cream, 18 ounces of milk and 0.84 ounce of milk-sugar. These amounts in 24 ounces give 5 per cent of fat (accurate), 7.38 per cent of carbohydrates (0.38 per cent off) and 3.02 per cent of proteins (0.48 off), practically a 5-7-3 mixture instead of a 5-7-3.50 mixture as far as the proteins are concerned.

By our table we find in 24 ounces of a 5-7-3.50 mixture we require of milk 22.08 ounces, cream 1.92 ounces and milk-sugar 0.6 ounce. These amounts give of fat 4.96 per cent (0.04 off), carbohydrates 6.96 per cent (0.04 off) and proteins 3.47 per cent (but 0.03 off).

Had the tables been carried out to one more decimal place all calculations would have been within 0.01 per cent of absolute accuracy.

If barley water or other cereal water is used, as recommended by many to assist in breaking up the curd, it, too, may be added in the quantity desired before adding the water. Since

barley water contains of fat 0.05 per cent, carbohydrates 1.63 per cent and proteins 0.09 per cent (Holt), when it alone is used as the diluent, a reduction should be made in the carbohydrate per cent of the formula; e. g., if a 3-6-1 mixture is desired the ingredients of a 3-5-1 mixture should be used, the percentage of the carbohydrates being subsequently raised by the addition of the barley water. The same point must be observed when adding the various dextrinizing powders to the milk mixtures. The dextrinizing process raises the sugar content about 2 per cent, so if a 3-6-1 mixture were desired, the ingredients of a 3-4-1 mixture are dextrinized.

In the modification of cow's milk by any formula it is essential to know the composition of the milk and cream used and while it is true that average herd milk is usually 4 per cent and gravity usually 16 per cent it is advisable to make the simple fat estimations with the Babcock centrifuge from time to time, for if the fat percentage is correct, the amounts of the other ingredients will also be correct.

CARE OF BABIES IN HOT WEATHER.

The following is a brochure¹ issued by the Babies' Milk Fund Association of Louisville in 1908 on the Care of Babies in Hot Weather, which was distributed among the poor and sent to every new mother whose confinement was reported to the city health office:

TO KEEP THE BABY WELL.

1. Give it *pure air* day and night.
2. Give it no food but *mother's milk*, or milk from the bottle, or food directed by a physician.
3. Whenever it cries or is fretful, do not offer it food, but *give it water*.
4. Be sure that it *gets enough sleep*—two naps, at least, during the day.
5. Do *not* put too much *clothing* on it.
6. *Bathe* it every day in a tub.
7. Don't handle it; *let it alone*.

¹ Compiled by Letchworth Smith, M.D.

THE CARE OF BABIES IN HOT WEATHER.

Clothing.—In the hot weather a thin gauze shirt, a thin muslin slip, and a diaper. On the hottest days, the slip and diaper are enough.

Keep the baby as cool and comfortable as possible.

As soon as a diaper is soiled *it should be removed*. Place it in a pail with a cover to keep the odors in and the flies out. Cover it with water and wash as soon as possible in hot water, to which a little soda has been added. The diaper should be *well rinsed and thoroughly dried* before being worn again.

At least once a week all diapers should be *thoroughly boiled*.

After every movement the parts soiled should be *carefully cleansed* at once. Babies often get sick from being left in soiled diapers. Never think of putting on any kind of baby powder until the skin is clean and fairly dry.

If the skin becomes chafed in any of the cracks or wrinkles apply a little zinc oxide ointment.

Bathing.—The best time for the bath is just before a feeding—if possible, at the same time each day.

The baby should be bathed every day in a tub.

The water should be slightly warmer than its own body.

Use soap that will not irritate its skin.

Do not bathe within an hour after eating.

In very hot weather finish the bath with a little cooler water, and give three or four general spongings during the day with cool water containing a little salt.

If the child suffers from “prickly heat,” bathe the affected skin with vinegar and water. But remember that a roughened or inflamed skin may be the sign of an infectious disease that needs the care of a physician.

Sleep.—After the bath *let the baby sleep* for two hours.

Such a mid-day nap should be *insisted on* until the child is a year old, and is *advisable* until the age of four.

Cover the child only with a light sheet when it is hot.

Fresh Air.—*Fresh air is very necessary.*

Leave the windows wide open. Never put a child to sleep in a closed-up room.

Keep it out of doors as much as possible.

Avoid the sun on hot days. Keep on the shady side of the street, or in shady spots in the park, or in any shady spots where the air is fresh.

Bed.—A baby's bed should be *flat, firm, clean and dry*.

Feather pillows are bad things for babies to lie on, especially in the summer.

Feeding.—*Every mother should nurse her baby, if she can possibly do so.*

No other food is so good for a baby as mother's milk.

Of the babies that die before they get to be a year old, nine out of every ten are bottle fed.

Wash the nipple with cold water before and after each nursing.

The mother should eat plain, well-cooked food and should see to it that her bowels move at least once each day. Constipation in the mother is bad for both mother and child.

She should be *careful as to diet and habits of life*. Beer and tea are harmful, and in large quantities (two pints or more daily) may be very injurious.

Regular Feeding.—*Regularity in feeding* is one of the most important things in the care of a baby. Irregularity in feeding leads to over-feeding in most cases, and often causes sickness, diarrhea and death.

Feed the child at *regular intervals*.

Do not nurse it every time it cries. A child is not always hungry when it cries, but it will eat at almost any time that food is offered. If it eats before its stomach is ready for a fresh supply of food, it may become sick.

The baby's stomach should be given a certain length of *time to digest* the food that is put into it. It should then have a little *rest* before it is called on to digest more food. If it is not allowed to rest, but kept at work constantly, it will become *exhausted*, and that means that the baby will be sick.

If a baby cries between feedings give it a *drink of water* that has been boiled and then cooled, with nothing in it.

Even very young nursing babies should have water in hot weather between feedings. This can be given out of a spoon or a perfectly clean nursing bottle.

Breast Feeding.—*From the Third Day to the Sixth Week.*—The baby should be nursed, every two hours during the day, 6, 8, 10, 12, 2, 4, 6, 8, and should be nursed *only twice* between 10 p. m. and 6 a. m., not more than 10 feedings during the 24 hours. The baby should *not be allowed* to nurse more than 20 minutes at a time. Nursing longer than this may give the stomach more than it can properly digest before time for the next nursing.

From the Sixth Week to the Third Month.—During the day six nursings, two and one-half hours apart, at 6, 8.30, 11, 1.30, 4 and 6.30. From that time on till morning only two nursings should be allowed.

From the Third to the Sixth Month. The nursings should be three hours apart during the day, at 6, 9, 12, 3, 6, 10, with one only between that hour and 6 o'clock the next morning.

From the Sixth to the Ninth Month.—The times of feeding remain the same but *the night feeding should be discontinued*. The child may wake up in the night, but should be given a drink of cooled, boiled water. After a short time, if it is well, it will sleep through the night.

From the Ninth to the Twelfth Month.—Nursings three and one-half hours apart. Five in number. None at night.

Bottle Feeding.—If it is absolutely impossible for a mother to nurse her baby, it may be possible to find a wet-nurse. If this cannot be done, it will be necessary to put the baby on the milk of some animal.

Cow's milk should not be given to young babies much under a year old unless it is diluted with certain amounts of clean water or barley water.

The *best milk* you can get is not too good for the baby.

If you cannot afford to drink good milk yourself, you may be able to get along without it, but *the baby needs milk* and the *cleanest milk* that can be obtained. Cheap milk is not clean. It is usually keeping milk from getting dirty that makes it expensive.

All babies should have milk that is clean enough to be *certified*.

All other milk should be heated to boiling as soon as it is purchased.

To keep milk sweet get it from the milkman whose wagons, cans and horses look clean. If you know where he keeps his cows, go and see if he keeps them clean.

Get your milk in a bucket *with a cover* so that the flies and dust can be kept out of it. See that the pail is *well washed, scalded* and turned upside down when not in use.

Always keep the milk covered. Always keep it cold.

If you cannot get ice, keep it in cold running water, or if this is not possible, wrap a damp cloth about the pail and set it in a draft of air.

Feeding After One Year of Age.—Children should be weaned when 12 months old, unless the weather is very hot or a physician orders otherwise.

Wean gradually.—At first substitute one bottle for one nursing. After a few days give two bottles a day, and so on.

Bottle-fed children at this age will require more than milk, although this should still form the chief part of their food.

During the second year most children are badly fed.

Four meals a day should be given, selected from the following:

Soft-boiled eggs; strained broths of beef, mutton and chicken, containing small pieces of stale or toasted bread; stale bread or toast with milk; hominy (cooked six hours) with milk; oatmeal or rice (cooked three hours) with milk; cornmeal (cooked two hours) with milk; farina (cooked one hour) with milk. The milk should be boiled unless it is *certified* milk. Do not feed meat, vegetables, candy, popcorn, sugar, bananas or anything else unless told to do so by a physician.

Summer Diarrhea.—When the baby has loose, green passages, it means that the baby is sick and needs medical attention. The disease is mild at first and often shows no other signs of illness than the diarrhea. There may be no fever. Such a baby often becomes dangerously ill in a short time.

The simplest case of vomiting and diarrhea during the summer should not be neglected.

Stop the milk at once.

Give two teaspoonfuls of castor oil and feed nothing but barley water until the child can be taken to a doctor.

Do not give it any cordials or teas or "diarrhea mixtures."

Flies.—Remember that flies are dirty, and often carry disease.

Keep milk and other food covered or where flies cannot get at it.

The fly that falls into the milk bucket may have just come from a privy used by a person having typhoid fever, and if so the one drinking the milk may contract the disease.

Keep the soiled diapers covered so that flies cannot walk over them and then go to the food used in the family.

Windows and doors should be screened, especially if there is a baby in the family.

Give the Baby a Chance.—Do not get it in the habit of being held by its mother or by other children.

Most babies suffer because they are used to amuse older people, and are forced to laugh or are tossed about and excited when they need to be resting quietly.

Get it early into the habit of going to sleep without being rocked. It is much better for the baby to learn to go to sleep without this motion, and to have it do so will save much time for the mother and enable her to do many more important things in the way of keeping things clean, and of resting herself.

Children often cry when put down to sleep. If they are left alone and not handled or talked to they will soon go to sleep.

Crying is one of the ways in which babies develop their lungs—a certain amount of it is "natural," and will do no harm if you don't get nervous about it.

Try to get people to leave the baby alone. Think how tired and irritable you get yourself on a hot day, and shield the baby as much as possible from excitement and "attention."

"Some of these things may seem like extra work, but they keep the baby well, and it is far less trouble to keep a baby well than to take care of a sick baby."

A MOTHER.

MILK MODIFICATIONS.**Suggestive Table of Feedings.¹**

Remove the top 9 ounces from 1 quart of bottled milk into pitcher or bowl. Of this milk in the pitcher or bowl use 4 ounces with 14 ounces of water or dextrinized gruel and two level tablespoonfuls of sugar. (F. 2.7, S. 6., P. .7.)

Divide into nine feedings of 2 ounces each in separate nursing bottles, and feed every two hours during the day and twice at night.

TWO TO FOUR WEEKS.

Remove the top 9 ounces from 1 quart of bottled milk into a pitcher or bowl. Of this milk in the pitcher or bowl use 7 ounces with 20 ounces of water or dextrinized gruel and 3 level tablespoonfuls of sugar. (F. 3., S. 7., P. 1.)

Divide into nine feedings of 2 to 3 ounces each in separate nursing bottles, and feed every two hours during the day and twice at night.

SECOND MONTH.

Remove the top 11 ounces from 1 quart of bottled milk into a pitcher or bowl. Of this milk in the pitcher or bowl use the entire 11 ounces with 22 ounces of water or gruel and 4 level tablespoonfuls of sugar. (F. 3., S. 7., P. 1.)

Divide into eight feedings of 3 to 4 ounces each in separate nursing bottles, and feed every two and one-half hours during the day and once at night.

THIRD MONTH.

Remove the top 16 ounces from 1 quart of bottled milk into a pitcher or bowl. Of this milk in the pitcher or bowl use 14 ounces with 18 ounces of water or gruel and 4 level tablespoonfuls of sugar. (F. 3., S. 7., P. 1.4.)

Divide into seven feedings of 4 to 5 ounces each in separate nursing bottles, and feed every two and one-half to three hours during the day and once at night.

¹ Chapin: Theory and Practice of Infant Feeding.

FOUR TO SIX MONTHS.

Remove the top 20 ounces from 1 quart of bottled milk into a pitcher or bowl. Of this top milk in the pitcher or bowl use the entire quantity with 16 ounces of water or gruel and 4 level tablespoonfuls of sugar. (F. 3., S. 7., P. 2.)

Divide into six feedings of 5 to 6 ounces each in separate nursing bottles, and feed every three hours during the day and once at night.

SEVEN TO NINE MONTHS.

Remove the top 24 ounces from each 2 quarts of bottled milk into a pitcher or bowl. Of this milk in the pitcher or bowl use 33 ounces with 15 ounces of water or gruel and 4 level tablespoonfuls of sugar. (F. 3.5, S. 7., P. 2.2.)

Divide into six feedings of 7 to 8 ounces each in separate nursing bottles, and feed every three hours during the day.

TEN TO TWELVE MONTHS.

Remove the top 24 ounces from each of 2 quart bottles of milk into a pitcher or bowl. Of this milk in the pitcher or bowl use 40 ounces with 8 ounces of water or gruel and 4 level tablespoonfuls of sugar. (F. 4., S. 7., P. 2.6.)

Divide into five feedings of 8 to 10 ounces each in separate nursing bottles, and feed every three and one-half hours.

TWELVE TO FOURTEEN MONTHS.

Whole milk, or, if not digested well, add one-fourth gruel. Amount in the bottle from 9 to 12 ounces. Chicken, mutton or beef broths, in same amount, may also be given.

SUGGESTIVE FORMULÆ (HOLT).

First Series of Formulæ. Fat to proteids, 3: 1.

Primary Formulæ. Ten per cent milk or fat 10 per cent, sugar 4.3 per cent, proteids 3.3 per cent. Obtained (1) as upper portion of bottled milk, or (2) equal parts milk and (16 per cent) cream.

DERIVED FORMULAS, GIVING QUANTITIES FOR TWENTY-OUNCE MIXTURES.

								Fat per cent	Sugar per cent	Pro- teids per cent
I	{ Milk sugar, 1 oz. Lime-water, 1 oz. Water qs. to 20 oz, }			with 2 oz. of 10% milk =				1.00	5.00	0.33
II	"	"	20 oz.	"	3 oz.	"	10% " =	1.50	5.50	0.50
III	"	"	20 oz.	"	4 oz.	"	10% " =	2.00	6.00	0.66
IV	"	"	20 oz.	"	5 oz.	"	10% " =	2.50	6.00	0.83
V	"	"	20 oz.	"	6 oz.	"	10% " =	3.00	6.00	1.00
VI	"	"	20 oz.	"	7 oz.	"	10% " =	3.50	6.50	1.16

Second Series of Formulæ. Fat to proteids, 2:1.

Primary Formula. Seven per cent milk or fat 7 per cent, sugar 4.40 per cent, proteids 3.50 per cent. Obtained (1) as upper portion of bottled milk, or (2) by using three parts milk and one part (16 per cent) cream.

DERIVED FORMULAS, GIVING QUANTITIES FOR TWENTY-OUNCE MIXTURES.

							Fat per cent	Sugar per cent	Pro- teids per cent	
I	{ Milk sugar, 1 oz. Lime-water, 1 oz. Water qs. to 20 oz. }		with 3 oz. of 7% milk =				1.00	5.50	0.50	
II	"	"	20 oz.	"	4 oz.	" 7% "	=	1.40	5.75	0.70
III	"	"	20 oz.	"	5 oz.	" 7% "	=	1.75	6.00	0.87
IV	"	"	20 oz.	"	6 oz.	" 7% "	=	2.10	6.00	1.05
V	"	"	20 oz.	"	7 oz.	" 7% "	=	2.50	6.50	1.25
VI	"	"	20 oz.	"	8 oz.	" 7% "	=	2.80	6.50	1.40
VII	"	"	20 oz.	"	9 oz.	" 7% "	=	3.15	7.00	1.55
VIII	"	"	20 oz.	"	10 oz.	" 7% "	=	3.50	7.00	1.75
IX	{ Milk sugar, ¾ oz. Lime-water 1 oz. Water qs. to 20 oz. }		"	12 oz.	"	7% "	—	4.00	7.00	2.00

Third Series of Formulæ.—Fat to proteids, 8:7.

Primary Formula.—Plain milk: Fat 4 per cent, sugar 4.5 per cent, proteids 3.5 per cent. (When using Jersey or Alderney milk add one-fourth water.)

DERIVED FORMULAS, GIVING QUANTITIES FOR TWENTY-OUNCE MIXTURES.

						Fat per cent	Sugar per cent	Pro- teids per cent
I	{ Milk sugar, 1 oz. Lime-water, 1 oz. Water qs. to 20 oz. }		with 5 oz. plain milk =			1.00	6.00	0.87
II	"	"	20 oz.	"	6 oz.	"	"	1.20
III	"	"	20 oz.	"	8 oz.	"	"	1.60
IV	"	"	20 oz.	"	10 oz.	"	"	2.00
V	{ Milk sugar, ½ oz. Lime-water, 1 oz. Water qs. to 20 oz. }		" 12 oz.			"	"	2.40
VI	"	"	20 oz.	"	14 oz.	"	"	2.80
VII	"	"	20 oz.	"	16 oz.	"	"	3.20

SUGGESTIVE FORMULÆ (KERLEY).

Kerley¹ suggests the following formulæ by diluting the top 16 ounces milk; this will analyze, fat, 7 per cent, sugar 3.2 per cent, proteids 3.2 per cent.

FROM THE THIRD TO THE TENTH DAY.

		Ounces.			Approximate Percentage Equivalent.
Milk (top 16 oz.)	.....	3	Fat	.....	1.3
Lime-water	.....	½	Sugar	.....	6.6
Milk sugar	.....	1	Total proteid	.....	0.6
Boiled water to make	....	16			

Ten feedings in twenty-four hours; 1 to 1½ ounces at each feeding.

FROM TENTH TO THE TWENTY-FIRST DAY.

Milk (top 16 oz.)	.....	6	Fat	.....	1.75
Lime-water	.....	1½	Sugar	.....	6.8
Milk sugar	.....	1½	Total proteid	.....	0.3
Water to make	.....	24			

Nine to ten feedings in twenty-four hours; 1½ ounces at each feeding.

FROM THE THIRD TO THE SIXTH WEEK.

Milk (top 16 oz.)	.....	10	Fat	.....	2.2
Lime-water	.....	22½	Sugar	.....	7.0
Milk sugar	.....	2	Total proteid	.....	1.0
Water to make	.....	32			

Eight to nine feedings in twenty-four hours; 2 to 3 ounces each feeding.

¹ Kerley: Treatment of Diseases of Children.

FROM THE SIXTH WEEK TO THE THIRD MONTH.

	<i>Ounces.</i>		<i>Approximate Percentage Equivalent.</i>
Milk (top 16 oz.)	12	Fat	2.6
Milk sugar	2	Sugar	7.2
Lime-water	3	Total proteid	1.2
Water to make	32		

Seven to eight feedings in twenty-four hours; 2½ to 4 ounces at feeding.

FROM THE THIRD TO THE FIFTH MONTH.

After this age two bottles of milk are required, 16 ounces being taken from the top of each bottle and mixed. At this time a cereal jelly is usually added to the food.

Milk (top 16 oz.)	18	Fat	3.15
Milk sugar	2	Sugar	6.4
Lime-water	4	Total proteid	1.4
Water to make	40		

Six feedings in twenty-four hours; 4 to 5 ounces at each feeding.

FROM FIFTH TO THE SEVENTH MONTH.

Milk (top 16 oz.)	21	Fat	3.50
Milk sugar	2	Sugar	6.4
Lime-water	5	Total proteid	1.6
Water to make	42		

Six feedings in twenty-four hours; 5 to 7 ounces at each feeding.

FROM THE SEVENTH TO THE NINTH MONTH.

Milk (top 16 oz.)	27	Fat	3.9
Milk sugar	2½	Sugar	7.0
Lime-water	6	Total proteid	1.8
Water to make	48		

Five to six feedings in twenty-four hours; 7 to 9 ounces at each feeding.

FROM THE NINTH TO THE TWELFTH MONTH.

Milk (top 16 oz.)	35	Fat	4.3
Milk sugar	2½	Sugar	6.5
Lime-water	6	Total proteid	2.0
Water to make	56		

The following are formulæ as used by the **Babies' Milk Fund Association** adapted milk laboratory:

	<i>Per cent.</i>		<i>Ounces.</i>
Fat	1	Whole milk	8
Sugar	6	Lime-water	2
Proteid	1	10 per cent sugar solution	11
		Water	11

8 BOTTLES; 4 OUNCES.

	<i>Per cent.</i>		<i>Ounces.</i>
Fat	2	Top 9 ounces milk	4½
Sugar	7	Bottom or skim milk	3
Proteid	1	10 per cent sugar solution.....	17½
		Water	3

7 BOTTLES; 4 OUNCES EACH.

Fat	3	Top 12 ounces milk	6
Sugar	6	Bottom or skim milk	4
Proteid	1	10 per cent sugar solution	17
		Water	8

7 BOTTLES; 5 OUNCES EACH.

Fat	3.5	Top 12 ounces milk	6
Sugar	7	Bottom or skim milk	18
Proteid	2	10 per cent sugar solution	13
		Water	3

6 BOTTLES; 7 OUNCES EACH.

Fat	1.3	Top 16 ounces from quart	3
Sugar	6.6	Lime-water	½
Proteid	0.6	Milk sugar	1
		Water q. s.	16
Fat	2.2	Top 16 ounces	10
Sugar	7	Lime-water	2½
Proteid	1	Milk sugar	2
		Water q. s.	32
Fat	2.6	Top 16 ounces	12
Sugar	7	Milk sugar	2
Proteid	1	Lime-water	3
		Water q. s.	32
Fat	3.1	Top 16 ounces from two quarts..	21
Sugar	7	Milk sugar	2½
Proteid	1.6	Lime-water	5
		Water q. s.	42
Fat	3.93	Top 16 ounces from two quarts..	27
Sugar	7	Lime-water	6
Proteid	1.8	Milk sugar	2½
		Water q. s.	48
Fat	4.3	Top 16 ounces from two quarts..	35
Sugar	7.3	Milk sugar	3
Proteid	2.0	Lime-water	6
		Water q. s.	56

HESS REFRIGERATOR.

Dr. Alfred Hess¹ of New York has suggested an inexpensive home-made refrigerator which, if it could be put into general

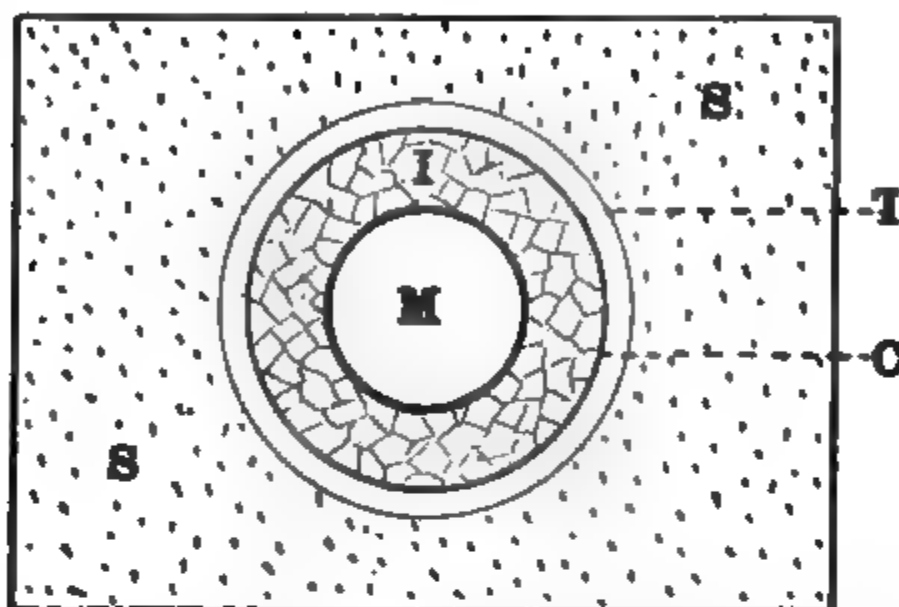


Fig. 105.—Hess home-made refrigerator. Horizontal section. M, milk container, I, broken ice; C, can for holding ice; T, tin or galvanized iron cylinder to prevent sawdust, S, from falling into space when can is removed for purpose of emptying water.

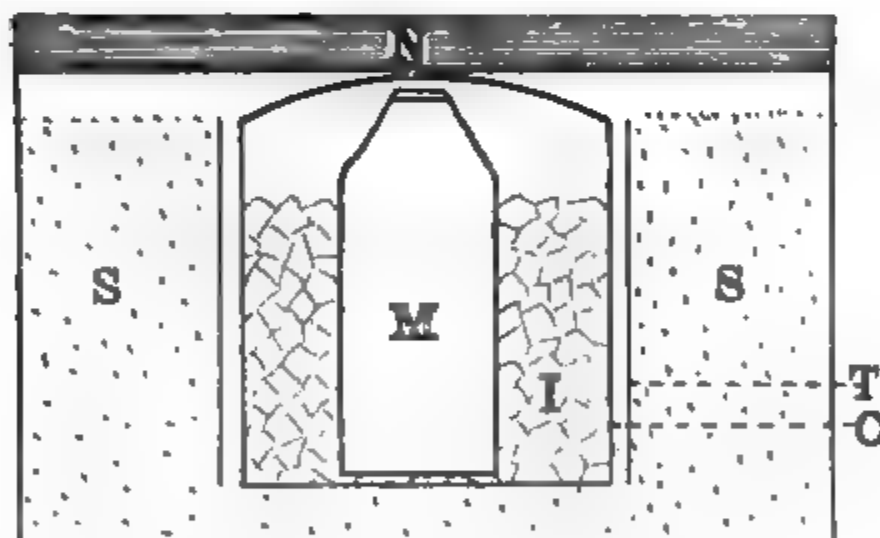


Fig. 106.—Hess home-made refrigerator. Vertical section S, sawdust, excelsior or other cheap non-conductor of heat; T, cylinder of tin or galvanized iron; C, can in which is placed the milk jar, M, surrounded by broken ice, I, newspapers nailed to lid of case.

use among the poor, would prevent many cases of milk poisoning among children who are fed milk teeming with bacteria, because it has not been kept cold.

¹ *Journal American Medical Association*, vol. II, no. 4.

The illustrations given on page 631 show the construction of the box.

METHODS AND STANDARDS FOR THE PRODUCTION AND DISTRIBUTION OF "CERTIFIED MILK."¹

ADOPTED BY THE AMERICAN ASSOCIATION OF MEDICAL MILK COMMISSIONS, MAY 1, 1912.

Certified milk is the product of dairies operated in accordance with accepted rules and regulations formulated by authorized medical milk commissions to insure its purity and adaptability for infants and invalids.

The need for such a milk was experienced primarily by those engaged in the conservation of the life and health of infants. As a result there was formulated in 1892 a plan whereby certified milk would be produced by a dairyman under the control of a medical milk commission designated by a representative medical society.

The first rules designed for this purpose were those contained in an agreement entered into by a medical milk commission and the dairyman concerned.²

The rules contained in the original agreement mentioned represented the essential requirements for the production of certified milk. Following this precedent, other commissions were organized, which, in 1906, became federated into a national association known as the American Association of Medical Milk Commissions.

A fundamental object of this association was to bring about the uniformity of standards and their perfection. This result has been reached by the adoption from time to time of definite

¹ At the fifth annual meeting of the American Association of Medical Milk Commissions, held in Philadelphia May 25, 1911, a committee was appointed to revise the manual of working methods and standards for the guidance of medical milk commissions in the supervision of the production and distribution of certified milk. The committee consisted of Dr. J. W. Kerr (chairman), Dr. S. McC. Hamill, and Dr. Henry L. Coit. This, their report, was adopted at the sixth annual meeting, held at Louisville, Ky., May 1, 1912, as the working methods and standards of the association. The association recommends them to component commissions as ideal and to be as closely approximated as possible. The report includes a statement concerning the certified-milk movement, as well as the revised methods and standards, and is published for the information of those interested in the improvement of public milk supplies.

Reprint from the Public Health Reports, vol. xxvii, no. 24, June 14, 1912.

² Bul. 56, Hygienic Laboratory, Public Health and Marine Hospital Service, p. 615.

standards relating to the veterinary inspection of herds and farms, the medical inspection of employees handling the milk, and the bacteriological and chemical examinations as to quality and purity. The requirements with respect to these four topics have been previously reported upon by committees and adopted by the association, and at its last annual meeting provision was made for their further revision and amplification.

ORGANIZATION OF MEDICAL MILK COMMISSIONS.

The medical milk commission is appointed by a representative medical society, and acts under its auspices and for it, to encourage the production of milk of the highest possible standards of purity. No commission should be considered as certifying milk that does not conform to the standards adopted from time to time by the Association of Medical Milk Commissions. The commission should include at least five members or a number sufficient to become responsible for and to carry on the following divisions of work: (*a*) The hygiene of the dairy, as it relates to the production and distribution of the milk; (*b*) the veterinary supervision of the herd; (*c*) the medical supervision of the employees; (*d*) the chemical and bacteriological examinations of the milk.

DUTIES OF THE COMMISSION.

After its organization the commission should designate a veterinarian, a physician, a chemist, and a bacteriologist to enforce its methods and standards which shall be the prevailing methods and standards of the American Association of Medical Milk Commissions, and these officers should be required to render regular reports of their inspections and examinations. A uniform written agreement should then be entered into with any dairyman who is desirous of undertaking the production of certified milk and the investigation of whose plant shows it to be properly equipped for such purpose. Such agreement shall require the observance of the methods and standards hereinafter mentioned.

Upon receipt of favorable reports from the several experts

and committees which have made the investigations, the dairyman should be authorized, in accordance with the terms of the agreement, to employ the term "certified milk," and he shall be required to attach to all containers of any character used in distributing the milk produced under the agreement a certificate or seal bearing the term "certified milk," the name of the medical milk commission certifying it, and the day or date of production of the milk contained therein.

HYGIENE OF THE DAIRY.

UNDER THE SUPERVISION AND CONTROL OF THE VETERINARIAN

1. **Pastures or Paddocks.**—Pastures or paddocks to which the cows have access shall be free from marshes or stagnant pools, crossed by no stream which might become dangerously contaminated, at sufficient distances from offensive conditions to suffer no bad effects from them, and shall be free from plants which affect the milk deleteriously.

2. **Surroundings of Buildings.**—The surroundings of all buildings shall be kept clean and free from accumulations of dirt, rubbish, decayed vegetable or animal matter or animal waste, and the stable yard shall be well drained.

3. **Location of Buildings.**—Buildings in which certified milk is produced and handled shall be so located as to insure proper shelter and good drainage, and at sufficient distance from other buildings, dusty roads, cultivated and dusty fields, and all other possible sources of contamination; provided, in the case of unavoidable proximity to dusty roads or fields, the exposed side shall be screened with cheesecloth.

4. **Construction of Stables.**—The stables shall be constructed so as to facilitate the prompt and easy removal of waste products. The floors and platforms shall be made of cement or other nonabsorbent material, and the gutters of cement only. The floors shall be properly graded and drained, and the manure gutters shall be from 6 to 8 inches deep and so placed in relation to the platform that all manure will drop into them.

5. The inside surface of the walls and all interior construction shall be smooth, with tight joints, and shall be capable of

shedding water. The ceiling shall be of smooth material and dust-tight. All horizontal and slanting surfaces which might harbor dust shall be avoided.

6. Drinking and Feed Troughs.—Drinking troughs or basins shall be drained and cleaned each day, and feed troughs and mixing floors shall be kept in a clean and sanitary condition.

7. Stanchions.—Stanchions when used shall be constructed of iron pipes or hardwood, and throat latches shall be provided to prevent the cows from lying down between the time of cleaning and the time of milking.

8. Ventilation.—The cow stables shall be provided with adequate ventilation either by means of some approved artificial device, or by the substitution of cheesecloth for glass in the windows, each cow to be provided with a minimum of 600 cubic feet of air space.

9. Windows.—A sufficient number of windows shall be installed and so distributed as to provide satisfactory light and a maximum of sunshine; 2 feet square of window area to each 600 cubic feet of air space to represent the minimum. The coverings of such windows shall be kept free from dust and dirt.

10. Exclusion of flies, etc.—All necessary measures should be taken to prevent the entrance of flies and other insects, and rats and other vermin into all the buildings.

11. Exclusion of Animals from the Herd.—No horses, hogs, dogs, or other animals or fowls shall be allowed to come in contact with the certified herd either in the stables or elsewhere.

12. Bedding.—No dusty or moldy hay or straw, bedding from horse stalls, or other unclean materials shall be used for bedding the cows. Only bedding which is clean, dry, and absorbent may be used, preferably shavings or straw.

13. Cleaning Stable and Disposal of Manure.—Soiled bedding and manure shall be removed at least twice daily, and the floors shall be swept and kept free from refuse. Such cleaning shall be done at least one hour before the milking time. Manure, when removed, shall be drawn to the field or temporarily stored in containers so screened as to exclude flies. Manure shall not be even temporarily stored within 300 feet of the barn or dairy building.

14. **Cleaning of Cows.**—Each cow in the herd shall be groomed daily, and no manure, mud, or filth shall be allowed to remain upon her during milking; for cleaning, a vacuum apparatus is recommended.

15. **Clipping.**—Long hairs shall be clipped from the udder and flanks of the cow, and from the tail above the brush. The hair on the tail shall be cut so that the brush may be well above the ground.

16. **Cleaning of Udders.**—The udders and teats of the cow shall be cleaned before milking; they shall be washed with a cloth and water, and dry wiped with another clean sterilized cloth—a separate cloth for drying each cow.

17. **Feeding.**—All foodstuffs shall be kept in an apartment separate from and not directly communicating with the cow barn. They shall be brought into the barn only immediately before the feeding hour, which shall follow the milking.

18. Only those foods shall be used which consist of fresh, palatable, or nutritious materials, such as will not injure the health of the cows or unfavorably affect the taste or character of the milk. Any dirty or moldy food or food in a state of decomposition or putrefaction shall not be given.

19. A well-balanced ration shall be used, and all changes of food shall be made slowly. The first few feedings of grass, alfalfa, ensilage, green corn, or other green feeds shall be given in small rations and increased gradually to full ration.

20. **Exercise.**—All dairy cows shall be turned out for exercise at least 2 hours in each 24 in suitable weather. Exercise yards shall be kept free from manure and other filth.

21. **Washing of Hands.**—Conveniently located facilities shall be provided for the milkers to wash in before and during milking.

22. The hands of the milkers shall be thoroughly washed with soap, water, and brush and carefully dried on a clean towel immediately before milking. The hands of the milkers shall be rinsed with clean water and carefully dried before milking each cow. The practice of moistening the hands with milk is forbidden.

23. **Milking Clothes.**—Clean overalls, jumper, and cap shall

be worn during milking. They shall be washed or sterilized each day and used for no other purpose, and when not in use they shall be kept in a clean place, protected from dust and dirt.

24. Things to be Avoided by Milkers.—While engaged about the dairy or in handling the milk employees shall not use tobacco nor intoxicating liquors. They shall keep their fingers away from their nose and mouth, and no milker shall permit his hands, fingers, lips, or tongue to come in contact with milk intended for sale.

25. During milking the milkers shall be careful not to touch anything but the clean top of the milking stool, the milk pail, and the cow's teats.

26. Milkers are forbidden to spit upon the walls or floors of stables, or upon the walls or floors of milk houses, or into the water used for cooling the milk or washing the utensils.

27. Fore Milk.—The first streams from each teat shall be rejected, as this fore milk contains large numbers of bacteria. Such milk shall be collected into a separate vessel and not milked onto the floors or into the gutters. The milking shall be done rapidly and quietly, and the cows shall be treated kindly.

28. Milk and Calving Period.—Milk from all cows shall be excluded for a period of 45 days before and 7 days after parturition.

29. Bloody and Stringy Milk.—If milk from any cow is bloody and stringy or of unnatural appearance, the milk from that cow shall be rejected and the cow isolated from the herd until the cause of such abnormal appearance has been determined and removed, special attention being given in the meantime to the feeding or to possible injuries. If dirt gets into the pail, the milk shall be discarded and the pail washed before it is used.

30. Make-up of Herd.—No cows except those receiving the same supervision and care as the certified herd shall be kept in the same barn or brought in contact with them.

31. Employees Other than Milkers.—The requirements for milkers, relative to garments and cleaning of hands, shall apply to all other persons handling the milk, and the children unat-

tended by adults shall not be allowed in the dairy nor in the stable during milking.

32. Straining and Strainers.—Promptly after the milk is drawn it shall be removed from the stable to a clean room and then emptied from the milk pail to the can, being strained through strainers made of a double layer of finely meshed cheesecloth or absorbent cotton thoroughly sterilized. Several strainers shall be provided for each milking in order that they may be frequently changed.

33. Dairy Building.—A dairy building shall be provided which shall be located at a distance from the stable and dwelling prescribed by the local commission, and there shall be no hogpen, privy, or manure pile at a higher level or within 300 feet of it.

34. The dairy building shall be kept clean and shall not be used for purposes other than the handling and storing of milk and milk utensils. It shall be provided with light and ventilation, and the floors shall be graded and water-tight.

35. The dairy building shall be well lighted and screened and drained through well-trapped pipes. No animals shall be allowed therein. No part of the dairy building shall be used for dwelling or lodging purposes, and the bottling room shall be used for no other purpose than to provide a place for clean milk utensils and for handling the milk. During bottling this room shall be entered only by persons employed therein. The bottling room shall be kept scrupulously clean and free from odors.

36. Temperature of Milk.—Proper cooling to reduce the temperature to 45° F. shall be used, and aerators shall be so situated that they can be protected from flies, dust, and odors. The milk shall be cooled immediately after being milked, and maintained at a temperature between 35° and 45° F. until delivered to the customer.

37. Sealing of Bottles.—Milk, after being cooled and bottled, shall be immediately sealed in a manner satisfactory to the commission, but such seal shall include a sterile hood which completely covers the lip of the bottle.

38. Cleaning and Sterilizing of Bottles.—The dairy building shall be provided with approved apparatus for the cleansing and

sterilizing of all bottles and utensils used in milk production. All bottles and utensils shall be thoroughly cleaned by hot water and sal soda, or equally pure agent, rinsed until the cleaning water is thoroughly removed, then exposed to live steam or boiling water at least 20 minutes, and then kept inverted until used, in a place free from dust and other contaminating materials.

39. **Utensils.**—All utensils shall be so constructed as to be easily cleaned. The milk pail should preferably have an elliptical opening 5 by 7 inches in diameter. The cover of this pail should be so convex as to make the entire interior of the pail visible and accessible for cleaning. The pail shall be made of heavy seamless tin, and with seams which are flushed and made smooth by solder. Wooden pails, galvanized-iron pails, or pails made of rough, porous materials, are forbidden. All utensils used in milking shall be kept in good repair.

40. **Water Supply.**—The entire water supply shall be absolutely free from contamination, and shall be sufficient for all dairy purposes. It shall be protected against flood or surface drainage, and shall be conveniently situated in relation to the milk house.

41. **Privies, etc., in Relation to Water Supply.**—Privies, pigpens, manure piles, and all other possible sources of contamination shall be so situated on the farm as to render impossible the contamination of the water supply, and shall be so protected by use of screens and other measures as to prevent their becoming breeding grounds for flies.

42. **Toilet Rooms.**—Toilet facilities for the milkers shall be provided and located outside of the stable or milk house. These toilets shall be properly screened, shall be kept clean, and shall be accessible to wash basins, water, nail brush, soap and towels, and the milkers shall be required to wash and dry their hands immediately after leaving the toilet room.

Transportation.

43. In transit the milk packages shall be kept free from dust and dirt. The wagon, trays, and crates shall be kept scrupulously clean. No bottles shall be collected from houses in which communicable diseases prevail, unless a separate wagon is used

and under conditions prescribed by the department of health and the medical milk commission.

44. All certified milk shall reach the consumer within 30 hours after milking.

Veterinary Supervision of the Herd.

45. **Tuberculin Test.**—The herd shall be free from tuberculosis, as shown by the proper application of the tuberculin test. The test shall be applied in accordance with the rules and regulations of the United States Government, and all reactors shall be removed immediately from the farm.¹

46. No new animals shall be admitted to the herd without first having passed a satisfactory tuberculin test, made in accordance with the rules and regulations mentioned; the tuberculin to be obtained and applied only by the official veterinarian of the commission.

47. Immediately following the application of the tuberculin test to a herd for the purpose of eliminating tuberculous cattle, the cow stable and exercising yards shall be disinfected by the veterinary inspector in accordance with the rules and regulations of the United States Government.¹

48. A second tuberculin test shall follow each primary test after an interval of six months, and shall be applied in accordance with the rules and regulations mentioned. Thereafter, tuberculin tests shall be reapplied annually, but it is recommended that the retests be applied semiannually.

49. **Identification of Cows.**—Each dairy cow in each of the certified herds shall be labeled or tagged with a number or mark which will permanently identify her.

50. **Herd-book Record.**—Each cow in the herd shall be registered in a herd book, which register shall be accurately kept so that her entrance and departure from the herd and her tuberculin testing can be identified.

51. A copy of this herd-book record shall be kept in the hands of the veterinarian of the medical milk commission under which the dairy farm is operating, and the veterinarian shall be made responsible for the accuracy of this record.

¹ See Circular of Instructions issued by the Bureau of Animal Industry for making tuberculin tests and for the disinfection of premises.

52. Dates of Tuberculin Tests.—The dates of the annual tuberculin tests shall be definitely arranged by the medical milk commission, and all of the results of such tests shall be recorded, by the veterinarian and regularly reported to the secretary of the medical milk commission issuing the certificate.

53. The results of all tuberculin tests shall be kept on file by each medical milk commission, and a copy of all such tests shall be made available to the American Association of Medical Milk Commissions for statistical purposes.

54. The proper designated officers of the American Association of Medical Milk Commissions should receive copies of reports of all of the annual, semiannual, and other official tuberculin tests which are made and keep copies of the same on file and compile them annually for the use of the association.

55. Disposition of Cows Sick with Diseases other than Tuberculosis.—Cows having rheumatism, leukorrhea, inflammation of the uterus, severe diarrhea, or diseases of the udder, or cows that from any other cause may be a menace to the herd shall be removed from the herd, placed in a building separate from that which may be used for the isolation of cows with tuberculosis, unless such building has been properly disinfected since it was last used for this purpose. The milk from such cows shall not be used, nor shall the cows be restored to the herd until permission has been given by the veterinary inspector after a careful physical examination.

56. Notification of Veterinary Inspector.—In the event of the occurrence of any of the diseases just described between the visits of the veterinary inspector, or if at any time a number of cows become sick at one time in such a way as to suggest the outbreak of a contagious disease or poisoning, it shall be the duty of the dairyman to withdraw such sickened cattle from the herd, to destroy their milk, and to notify the veterinary inspector by telegraph or telephone immediately.

57. Emaciated Cows.—Cows that are emaciated from chronic diseases or from any cause that in the opinion of the veterinary inspector may endanger the quality of the milk, shall be removed from the herd.

Bacteriological Standards.

58. **Bacterial Counts.**—Certified milk shall contain less than 10,000 bacteria per cubic centimeter when delivered. In case a count exceeding 10,000 bacteria per cubic centimeter is found, daily counts shall be made, and if normal counts are not restored within 10 days the certificate shall be suspended.

59. Bacterial counts shall be made at least once a week.

60. **Collection of Samples.**—The samples to be examined shall be obtained from milk as offered for sale and shall be taken by a representative of the milk commission. The samples shall be received in the original packages, in properly iced containers, and they shall be so kept until examined, so as to limit as far as possible changes in their bacterial content.

61. For the purpose of ascertaining the temperature, a separate original package shall be used, and the temperature taken at the time of collecting the sample, using for the purpose a standardized thermometer graduated in the centigrade scale.

62. **Interval Between Milking and Plating.**—The examinations shall be made as soon after collection of the samples as possible, and in no case shall the interval between milking and plating the samples be longer than 40 hours.

63. **Plating.**—The packages shall be opened with aseptic precautions after the milk has been thoroughly mixed by vigorously reversing and shaking the container 25 times.

64. Two plates at least shall be made for each sample of milk, and there shall also be made a control of each lot of medium and apparatus used at each testing. The plates shall be grown at 37° C. for 48 hours.

65. In making the plates there shall be used agaragar media containing 1.5 per cent agar and giving a reaction of 1.0 to phenolphthalein.

The following is the method recommended by a committee of the American Public Health Association for the making of the media, modified, however, as to the agar content and reaction to conform to the requirements specified in section 65:

1. Boil 15 grams of thread agar in 500 cc. of water for half an hour and make up weight to 500 g. or digest for 10 minutes in the autoclave at 110° C. Let this cool to about 60° C.

2. Infuse 500 g. finely chopped lean beef for 24 hours with its own weight of distilled water in the refrigerator.
3. Make up any loss by evaporation.
4. Strain infusion through cotton flannel, using pressure.
5. Weigh filtered infusion.
6. Add Witte's peptone, 2 per cent.
7. Warm on water bath, stirring until peptone is dissolved and not allowing temperature to rise above 60° C.
8. To the 500 grams of meat infusion (with peptone) add 500 g. of the 2 per cent agar, keeping the temperature below 60° C.
9. Heat over boiling water (or steam) bath 30 minutes.
10. Restore weight lost by evaporation.
11. Titrate after boiling one minute to expel carbolic acid.
12. Adjust reaction to final point desired $+ 1$ by adding normal sodium hydrate.
13. Boil two minutes over free flame, constantly stirring.
14. Restore weight lost by evaporation.
15. Filter through absorbent cotton or coarse filter paper, passing the filtrate through the filter repeatedly until clear.
16. Titrate and record the final reaction.
17. Tube (10 cc. to a tube) and sterilize in autoclave one hour at 15 pounds pressure or in the streaming steam for 20 minutes on three successive days.

66. Samples of milk for plating shall be diluted in the proportion of 1 part of milk to 99 parts of sterile water; shake 25 times and plate 1 cc. of the dilution.

The committee on bacterial milk analyses of the American Public Health Association in Part IV of its report presented details with respect to plating apparatus and technique in part as follows:

Plating apparatus.—For plating it is best to have a water bath in which to melt the media and a water-jacketed water bath for keeping it at the required temperature; a wire rack which should fit both the water baths for holding the media tubes; a thermometer for recording the temperature of the water in the water-jacketed bath, sterile 1 cc. pipettes, sterile Petri dishes, and sterile dilution water in measured quantities.

Dilutions.—Ordinary potable water, sterilized, may be used for dilutions. Occasionally spore forms are found in such water which resist ordinary autoclave sterilization; in such cases distilled water may be used or the autoclave pressure increased. With dilution water in 8-ounce bottles calibrated for 99 cubic centimeters . . . all the necessary dilutions may be made.

Short, wide-mouthed "blakes" or wide-mouthed French square bottles are more easily handled and more economical of space than other forms of bottles or flasks.

Eight-ounce bottles are the best, as the required amount of dilution water only about half fills them, leaving room for shaking. Long-fiber nonabsorbent cotton should be used for plugs. It is well to use care in selecting cotton for this purpose to avoid short-fiber or dusty cotton, which give a cloud of lint-like particles on shaking. Bottles . . . should be filled a little over the 99 cc. . . . to allow for loss during sterilization.

Pipettes.—Straight sides 1 cc. pipettes are more easily handled than those with bulbs; they may be made from ordinary three-sixteenths inch glass tubing and should be about 10 inches in length.

Plating technique.—The agar after melting should be kept in the water-jacketed water bath between 40° C. and 45° C. for at least 15 minutes before using to make sure that the agar itself has reached the temperature of the surrounding water. If used too warm, the heat may destroy some of the bacteria or retard their growth.

Shake the milk sample 25 times, then with a sterile pipette transfer 1 cc. to the first dilution water and rinse the pipette by drawing dilution water to the mark and expelling; this gives a dilution of 1 to 100.

. . . Then with a sterile pipette transfer 1 cc. to the Petri dish, using care to raise the cover only as far as necessary to insert the end of the pipette.

Take the tube of agar from the water bath, wipe the water from outside the tube with a piece of cloth, remove the plug, pass the mouth of the tube through a flame, and pour the agar into the plate, using the same care as before to avoid exposure of the plate contents to the air.

Carefully and thoroughly mix the agar and diluted milk in the Petri dish by a rotary motion, avoiding the formation of air bubbles or slopping the agar, and after allowing the agar to harden for at least 15 minutes at room temperature, place the dish bottom down in the incubator.

Plating should always be done in a place free from dust or currents of air.

In order that colonies may have sufficient food for proper development 10 cc. of agar shall be used for each plate.

67. Determination of Taste and Odor of Milk.—After the plates have been prepared and placed in the incubator, the taste and odor of the milk shall be determined after warming the milk to 100° F.¹

68. Counts.—The total number of colonies on each plate should be counted, and the results expressed in multiples of the dilution factor. Colonies too small to be seen with the naked eye or with slight magnification shall not be considered in the count.

¹ Should it be deemed desirable and necessary to conduct tests for sediment, the presence of special bacteria, or the number of leucocytes, the methods adopted by the committee of the American Public Health Association should be followed.

69. **Records of Bacteriologic Tests.**—The results of all bacterial tests shall be kept on file by the secretary of each commission, copies of which should be made available annually for the use of the American Association of Medical Milk Commissions.

Chemical Standards and Methods.

The methods that must be followed in carrying out the chemical investigations essential to the protection of certified milk are so complicated that in order to keep the fees of the chemist at a reasonable figure, there must be eliminated from the examination those procedures which, whilst they might be helpful and interesting, are in no sense necessary.

For this reason the determination of the water, the total solids and the milk sugar is not required as a part of the routine examination.

70. The chemical analyses shall be made by a competent chemist designated by the medical milk commission.

71. **Method of Obtaining Samples.**—The samples to be examined by the chemist shall have been examined previously by the bacteriologist designated by the medical milk commission, as to temperature, odor, taste, and bacterial content.

72. **Fat Standards.**—The fat standard for certified milk shall be 4 per cent, with a permissible range of variation of from 3.5 to 4.5 per cent.

73. The fat standard for certified cream shall be not less than 18 per cent.

74. If it is desired to sell higher fat-percentage milks or creams as certified milks or creams, the range of variation for such milks shall be 0.5 per cent on either side of the advertised percentage and the range of variations for such creams shall be 2 per cent on either side of the advertised percentage.

75. The fat content of certified milks and creams shall be determined at least once each month.

76. The methods recommended for this purpose are the Babcock (*a*), the Leffmann-Beam (*b*), and the Gerber (*c*).

(*a*) **Babcock test.**—The Babcock test is based on the fact that strong sulphuric acid will dissolve the nonfatty solid constituents of milk, and thus enable the fat to separate on standing. It can be conducted by any of the Babcock outfits which are purchasable in the market.

"The test is made by placing in the special test bottle 8 grams (17.6 cc.) of milk. To this is added, from a pipette, burette, or measuring bottle, 17.5 cc. commercial sulphuric acid of a specific gravity of 1.82 to 1.83. The contents of the bottle are carefully and thoroughly mixed by a rotary motion. The mixture becomes brown and heat is generated. The test bottle is now placed in a properly balanced centrifuge and whirled for 5 minutes at a speed of from 800 to 1,200 revolutions per minute. Hot water is then added to fill the bottle to the lower part of the neck, after which it is again whirled for two minutes. Now, enough hot water is added to float the column of fat into the graduated portion of the neck of the bottle, and the whirling is repeated for a minute. The amount of fat is read while the neck of the bottle is still hot. The reading is from the upper limits of the meniscus. A pair of calipers is of assistance in measuring the column of fat." (Jensen's Milk Hygiene, Leonard Pearson's translation.)

(b) *Leffmann-Beam test*.—The distinctive feature is the use of fusel oil, the effect of which is to produce a greater difference in surface tension between the fat and the liquid in which it is suspended, and thus promote its readier separation. This effect has been found to be heightened by the presence of a small amount of hydrochloric acid.

The test bottles have a capacity of about 30 cc. and are provided with a graduated neck, each division of which represents 9.1 per cent by weight of butter fat.

Fifteen centimeters of the milk are measured into the bottle, 3 cc. of a mixture of equal parts of amyl alcohol and strong hydrochloric acid added and mixed. Then 9 cc. of concentrated sulphuric acid is added in portions of about 1 cc.; after each addition the liquids are mixed by giving the bottle a gyratory motion. If the fluid has not lost all of its milky color by this treatment, a little more concentrated acid must be added. The neck of the bottle is now immediately filled at about the zero point with one part sulphuric acid and two parts water, well mixed just before using. Both the liquid in the bottle and the diluted acid must be hot. The bottle is then placed at once in the centrifugal machine; after rotation from one to two minutes, the fat will collect in the neck of the bottle and the percentage may be read off.

(c) *Gerber's test*.—This test is applied as follows: The test bottles are put into the stand with the mouths uppermost; then, with the pipette designed for the purpose, or with an automatic measurer, 10 cc. of sulphuric acid are filled into the test bottle, care being taken not to allow any to come in contact with the neck. The few drops remaining in the tip of the pipette should not be blown out. Then 11 cc. of milk are measured with the proper pipette and allowed to flow slowly onto the acid, so that the two liquids mix as little as possible. Finally, the amyl alcohol is added. (It is important to use the reagents in the proper order, which is—sulphuric acid, milk, amyl alcohol. If the sulphuric acid is followed by amyl alcohol and the milk last, then the result is sometimes in-

correct.) A rubber stopper, which must not be damaged, is then fitted into the mouth of the test bottle, and the contents are well shaken, the thumb being kept on the stopper to prevent it coming out. As a considerable amount of heat is generated by the action of the sulphuric acid on the milk, the test bottle should be wrapped in a cloth.

The shaking of the sample must be done thoroughly and quickly, and the test bottle inverted several times, so that the liquid in the neck becomes thoroughly mixed. By pressing in the rubber stopper the height of the liquid can be brought to about the zero point on the scale.

If only a few samples have to be analyzed and the room is warm, the test bottles can be put into the centrifuge without any preliminary heating, otherwise the test bottles must be warmed for a few minutes (not longer) in the water bath at a temperature of 60° to 65° C. When the temperature rises higher than this, say above 70° C., the rubber stopper is liable to be blown out of the test bottle. After the test bottles have been heated they are arranged symmetrically in the centrifuge and whirled for 3 to 4 minutes at a speed of about 1,000 revolutions per minute. When the centrifuge has a heating arrangement attached to it, the preliminary warming is not, of course, necessary. When the test bottles are taken out of the centrifuge, they are again placed in the water bath at a temperature of 60° to 65° C., and left there for several minutes before being read; where the centrifuge is heated, the tubes can be read off as taken from the centrifuge.

By carefully screwing in the rubber stopper, or even by pressing it, the lower limit of the fat column is brought onto one of the main divisions of the scale, and then, by holding the test bottle against the light the height of the column of fat can be accurately ascertained. The lowest point of the meniscus is taken as the level when reading the upper surface of the fat in a sample of whole milk, and the middle of the meniscus for separated milk.

If the column of fat is not clear and sharply defined, the sample must be again whirled in the centrifuge.

Each division on the scale is equivalent to 0.1 per cent, so it is very easy to read to 0.05 per cent, or, with a lens, to 0.025 per cent. If the number which is read off is multiplied by 0.1, then the percentage quantity of fat in the milk is obtained; e. g., if the number on the scale was 36.5, then the percentage of fat is 3.65. (Milk and Dairy Products, Barthel; translated by Goodwin, p. 71.)

77. Before condemning samples of milk which have fallen outside the limits allowed, the chemist shall have determined, by control ether extractions, that his apparatus and his technique are reliable.

78. **Protein Standard.**—The protein standard for certified

milk shall be 3.50 per cent with a permissible range of variation of from 3 to 4 per cent.

79. The protein standard for certified cream shall correspond to the protein standard for certified milk.

80. The protein content shall be determined only when any special consideration seems to the medical milk commission to make it desirable.

81. It shall be determined by the Kjeldahl method, using the Gunning or some other reliable modification, and employing the factor 6.25 in reckoning the protein from the nitrogen.

Kjeldahl method.—Five cubic centimeters of milk are measured carefully into a flat-bottom 800 cc. Jena flask. 20 cc. of concentrated sulphuric acid (C. P.; sp. gr., 1.84) are added, and 0.7 gram of mercuric oxid (or its equivalent in metallic mercury); the mixture is then heated over direct flame until it is straw-colored or perfectly white; a few crystals of potassium permanganate are now added till the color of the liquid remains green. All the nitrogen in the milk has then been converted into the form of ammonium sulphate. After cooling, 200 cc. of ammonia-free distilled water are added, 20 cc. of a solution of potassium sulphide (containing 40 grams sulphide per liter), and a fraction of a gram of powdered zinc. A quantity of semi-normal HCl solution more than sufficient to neutralize the ammonia obtained in the oxidation of the milk is now carefully measured out from a delicate burette (divided into $\frac{1}{20}$ cc.) into an Erlenmeyer flask and the flask connected with a distillation apparatus. At the other end the Jena flask containing the watery solution of the ammonium sulphate is connected, after adding 50 cc. of a concentrated soda solution (1 pound "pure potash" dissolved in 500 cc. of distilled water and allowed to settle); the contents of the Jena flask are now heated to boiling, and the distillation is continued for 40 minutes to an hour, until all ammonia has been distilled over.

The excess of acid in the Erlenmeyer receiving flask is then accurately titrated back by means of a tenth-normal standard ammonia solution, using a cochineal solution as an indicator. From the amount of acid used the per cent of nitrogen is obtained; and from it the per cent of casein and albumen in the milk by multiplying by 6.25. The amount of nitrogen contained in the chemicals used is determined by blank experiments and deducted from the nitrogen obtained as described. (Farrington and Woll, *Testing Milk and Its Products*, p. 221.)

82. **Coloring Matter and Preservatives.**—All certified milks and creams shall be free from adulteration, and coloring matter and preservatives shall not be added thereto.

83. Tests for the detection of added coloring matter shall be applied whenever the color of the milk or cream is such as to arouse suspicion.

Test for coloring matter.—The presence of foreign coloring matter in milk is easily shown by shaking 10 cc. of the milk with an equal quantity of ether; on standing, a clear ether solution will rise to the surface; if artificial coloring matter has been added to the milk, the solution will be yellow colored, the intensity of the color indicating the quantity added; natural fresh milk will give a colorless ether solution. (Testing Milk and its Products, Farrington and Woll, p. 244.)

84. Tests for the detection of formaldehyde, borax, and boracic acid shall be applied at least once each month. Occasionally application of tests for the detection of salicylic acid, benzoic acid, and the benzoates are also recommended.

Test for the detection of formaldehyde.—Five cubic centimeters of milk is measured into a white porcelain dish, and a similar quantity of water added; 10 cc. of HCl, containing a trace of Fe_2Cl_6 is added, and the mixture is heated very slowly. If formaldehyde is present, a violet color will be formed. (Testing Milk and Its Products, Farrington and Woll, p. 249.)

Test for boracic acid (borax, borates, preservaline, etc.).—One hundred cubic centimeters of milk are made alkaline with a soda or potash solution, and then evaporated to dryness and incinerated. The ash is dissolved in water, to which a little hydrochloric acid has been added, and the solution filtered. A strip of turmeric paper moistened with the filtrate will be colored reddish brown when dried at 100°C . on a watch glass, if boracic acid is present.

If a little alcohol is poured over the ash to which concentrated sulphuric acid has been added, and fire is set to the alcohol, after a little this will burn with a yellowish-green tint, especially noticeable if the ash is stirred with a glass rod and when the flame is about to go out.—(Testing Milk and Its Products, Farrington and Woll, p. 247.)

Test for salicylic acid (salicylates, etc.).—Twenty cubic centimeters of milk are acidulated with sulphuric acid and shaken with ether; the ether solution is evaporated, and the residue treated with alcohol and a little iron-chlorid solution; a deep violet color will be obtained in the presence of salicylic acid.—(Testing Milk and Its Products, Farrington and Woll, p. 248.)

Test for benzoic acid.—Two hundred and fifty to five hundred cubic centimeters of milk are made alkaline with a few drops of lime or baryta water, and then evaporated to about a quarter of the milk. Powdered gypsum is stirred into the remaining liquid until a paste is formed, which is then dried on the water bath. The gypsum only serves to hasten the

drying, and powdered pumice stone or sand can be used equally well. When the mass is dry, it is finely powdered and moistened with dilute sulphuric acid and shaken out three or four times with about twice the volume of 50 per cent alcohol, in which benzoic acid is easily soluble in the cold, the fat only being dissolved to a very slight extent or not at all. The acid alcoholic liquid from the various extractions, which contains milk sugar and inorganic salts in addition to the benzoic acid, is neutralized with baryta water and evaporated to a small bulk. Dilute sulphuric acid is again added, and the liquid shaken out with small quantities of ether. On evaporation of the ether, the benzoic acid is left behind in almost pure state, the only impurities being small quantities of fat or ash.

The benzoic acid which is obtained is dissolved in a small quantity of warm water, a drop of sodium acetate and neutral ferric chloride added, and the red precipitate of benzoate of iron indicates the presence of the acid. (Milk and Dairy Products, Barthel, translated by Goodwin, p. 121.)

85. Detection of Heated Milk.—Certified milk or cream shall not be subjected to heat unless specially directed by the commission to meet emergencies.

86. Tests to determine whether such milks and creams have been subjected to heat shall be applied at least once each month.

Detection of heated milk—Storch's method.—Five cubic centimeters of milk are poured into a test tube; a drop of weak solution of hydrogen dioxide (about 0.2 per cent) which contains about 0.1 per cent sulphuric acid, is added, and two drops of a 2 per cent solution of paraphenyldiamin (solution should be renewed quite often), then the fluid is shaken. If the milk or the cream becomes, at once, indigo blue, or the whey violet or reddish brown, then this has not been heated or, at all events, it has not been heated higher than 78° C. (172.5° F.); if the milk becomes a light bluish gray immediately or in the course of half a minute, then it has been heated to 79° to 80° C. (174.2° to 176° F.). If the color remains white, the milk has been heated at least to 80° C. (176° F.). In the examination of sour milk or sour buttermilk, lime water must be added, as the color reaction is not shown in acid solution.

Arnold's guaiac method.—A little milk is poured into a test tube and a little tincture of guaiac is added, drop by drop. If the milk has not been heated to 80° C. (176° F.) a blue zone is formed between the two fluids: heated milk gives no reaction, but remains white. The guaiac tincture should not be used perfectly fresh, but should have stood a few days and its potency have been determined. Thereafter it can be used indefinitely. These tests for heated milk are only active in the case of milks which have been heated to 176° F. or 80° C. (Jensen's Milk Hygiene, Pearson's translation, p. 192.)

Microscopic test for heated (pasteurized) milk—Frost and Ravenel.—

About 15 cc. of milk are centrifuged for five minutes, or long enough to throw down the leucocytes. The cream layer is then completely removed with absorbent cotton and the milk drawn off with a pipette, or a fine-pointed tube attached to a Chapman air pump. Only about 2 mm. of milk are left above the sediment which is in the bottom of the sedimentation tube.

The stain, which is an aqueous solution of safranin O, soluble in water, is then added very slowly from an opsonizing pipette. The important thing is to mix stain and milk so slowly that clotting does not take place. The stain is added until a deep opaque rose color is obtained. After standing three minutes, by means of the opsonizing pipette, which has been washed out in hot water, the stained sediment is then transferred to slides. A small drop is placed at the end of each of several slides and spread by means of a glass spreader, as in Wright's method for opsonic index determinations.

In an unheated milk the polymorphonuclear leucocytes have their protoplasm slightly tinged or are unstained.

In heated milk the polymorphonuclear leucocytes have their nuclei stained. In milk heated to 63° C. or above, practically all of the leucocytes have their nuclei definitely stained. When milk is heated at a lower temperature the nuclei are not all stained above 60° C. The majority, however, are stained.

87. Specific Gravity.—The specific gravity of certified milk shall range from 1.029 to 1.034.

88. The specific gravity shall be determined at least once each month.

The Quevenne lactodensimeter is recommended for the determination of the specific gravity. It is made like an ordinary aerometer and divided into degrees which correspond to a specific gravity from 1.014 to 1.040, or only from 1.022 to 1.038, since, by the latter division, a greater space is gained between the different degrees without unduly lengthening the instrument. From such a lactodensimeter one can easily read off four decimal places.

The milk the specific gravity of which is to be determined is well shaken and poured into a high glass cylinder of suitable diameter; the aerometer is dropped in slowly, in order to prevent its bobbing up and down. (The bulb should be free from adhering air bubbles.) The figures on the stem are the second and third decimals of the numbers of the specific gravity, so that 34 is to be read 1.034. For this examination, the temperature of the milk must be 15° C. (60° F.); if it is not, the specific gravity of the milk at 15° C. must be calculated from the specific gravity found and from the temperature, for in milk inspection and analysis this is the standard.

Methods and Regulations for the Medical Examination of Employees, their Health and Personal Hygiene.

89. A medical officer, known as the attending dairy physician, shall be selected by the commission who should reside near the dairy producing certified milk. He shall be a physician in good standing and authorized by law to practice medicine; he shall be responsible to the commission and subject to its direction. In case more than one dairy is under the control of the commission and they are in different localities, a separate physician should be designated for employment for the supervision of each dairy.

90. Before any person shall come on the premises to live and remain as an employee, such person, before being engaged in milking or the handling of milk, shall be subjected to a complete physical examination by the attending physician. No person shall be employed who has not been vaccinated recently or who upon examination is found to have a sore throat, or to be suffering from any form of tuberculosis, venereal disease, conjunctivitis, diarrhea, dysentery, or who has recently had typhoid fever or is proved to be a typhoid carrier, or who has any inflammatory disease of the respiratory tract, or any suppurative process or infectious skin eruption, or any disease of an infectious or contagious nature, or who has recently been associated with children sick with contagious disease.

91. In addition to ordinary habits of personal cleanliness all milkers shall have well-trimmed hair, wear close-fitting caps, and have clean-shaven faces.

92. When the milkers live upon the premises their dormitories shall be constructed and operated according to plans approved by the commission. A separate bed shall be provided for each milker and each bed shall be kept supplied with clean bedclothes. Proper bathing facilities shall be provided for all employees on the dairy premises, preferably a shower bath, and frequent bathing shall be enjoined.

93. In case the employees live on the dairy premises a suitable building shall be provided to be used for the isolation and quarantine of persons under suspicion of having a contagious disease.

The following plan of construction is recommended:

The quarantine building and hospital should be one story high and contain at least two rooms, each with a capacity of about 6,000 cubic feet and contain not more than three beds each, the rooms to be separated by a closed partition. The doors opening into the rooms should be on opposite sides of the building and provided with locks. The windows should be barred and the sash should be at least 5 feet from the ground and constructed for proper ventilation. The walls should be of a material which will allow proper disinfection. The floor should be of painted or washable wood, preferably of concrete, and so constructed that the floor may be flushed and properly disinfected. Proper heating, lighting, and ventilating facilities should be provided.

94. In the event of any illness of a suspicious nature the attending physician shall immediately quarantine the suspect, notify the health authorities and the secretary of the commission, and examine each member of the dairy force, and in every inflammatory affection of the nose or throat occurring among the employees of the dairy, in addition to carrying out the above-mentioned program, the attending physician shall take a culture and have it examined at once by a competent bacteriologist approved by the commission. Pending such examination, the affected employee or employees shall be quarantined.

95. It shall be the duty of the secretary, on receiving notice of any suspicious or contagious disease at the dairy, at once to notify the committee having in charge the medical supervision of employees of the dairy farm upon which such disease has developed. On receipt of the notice this committee shall assume charge of the matter, and shall have power to act for the commission as its judgment dictates. As soon as possible thereafter, the committee shall notify the commission, through its secretary, that a special meeting may be called for ultimate consideration and action.

96. When a case of contagious disease is found among the employees of a dairy producing certified milk under the control of a medical milk commission, such employee shall be at once quarantined and as soon as possible removed from the plant, and the premises fumigated.

When a case of contagion is found on a certified dairy it is advised that a printed notice of the facts shall be sent to every householder using the milk, giving in detail the precautions taken by the dairyman under the

direction of the commission, and it is further advised that all milk produced at such dairy shall be heated at 145° F. for 40 minutes, or 155° F. for 30 minutes, or 167° F. for 20 minutes, and immediately cooled to 50° F. These facts should also be part of the notice, and such heating of the milk should be continued during the accepted period of incubation for such contagious disease.

The following method of fumigation is recommended:

After all windows and doors are closed and the cracks sealed by strips of paper applied with flour paste, and the various articles in the room so hung or placed as to be exposed on all sides, preparations should be made to generate formaldehyde gas by the use of 20 ounces of formaldehyde and 10 ounces of permanganate of potash for every 1,000 cubic feet of space to be disinfected.

For mixing the formaldehyde and potassium permanganate a large galvanized-iron pail or cylinder holding at least 20 quarts and having a flared top should be used for mixing therein 20 ounces of formaldehyde and 10 ounces of permanganate. A cylinder at least 5 feet high is suggested. The containers should be placed about in the rooms and the necessary quantity of permanganate weighed and placed in them. The formaldehyde solution for each pail should then be measured into a wide-mouthed cup and placed by the pail in which it is to be used.

Although the reaction takes place quickly, by making preparations as advised all of the pails can be "set off" promptly by one person, since there is nothing to do but pour the formaldehyde solution over the permanganate. The rooms should be kept closed for four hours. As there is a slight danger of fire, the reaction should be watched through a window or the pails placed on a noninflammable surface.

97. Following a weekly medical inspection of the employees, a monthly report shall be submitted to the secretary of the medical milk commission, on the same recurring date by the examining visiting physician.

The following schedule, filled out in writing and signed by himself, is recommended as a suitable form for the attending physician's report:

This is to certify that, on the dates below indicated, official visits were made to the ——— dairy, owned and conducted by ——— of ——— (indicating town and State), where careful inspections of the dairy employees were made.

(a) Number and dates of visits since last report. ———.

(b) Number of men employed on the plant. ———.

(c) Has a recent epidemic of contagion occurred near the dairy, and what was its nature and extent ———.

(d) Have any cases of contagious or infectious disease occurred among the men since the last report? ———.

(e) Disposition of such cases. ———.

(f) What individual sickness has occurred among the men since the last report? ———.

(g) Disposition of such cases. ———.

(h) Number of employees now quarantined for sickness. ———.

(i) Describe the personal hygiene of the men employed for milking when prepared for and during the process of milking. ———.

(j) What facilities are provided for sickness in employees? ———.

(k) General hygienic condition of the dormitories or houses of the employees. ———.

(l) Suggestions for improvement. ———.

(m) What is the hygienic condition of the employees and their surroundings? ———.

(n) How many employees were examined at each of the foregoing visits? ———.

(o) Remarks. ———.

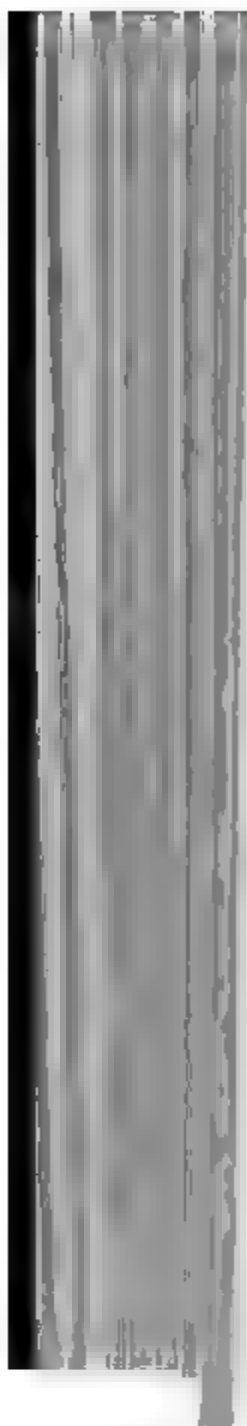
—————, —————,

Attending Physician.

Date, ———.



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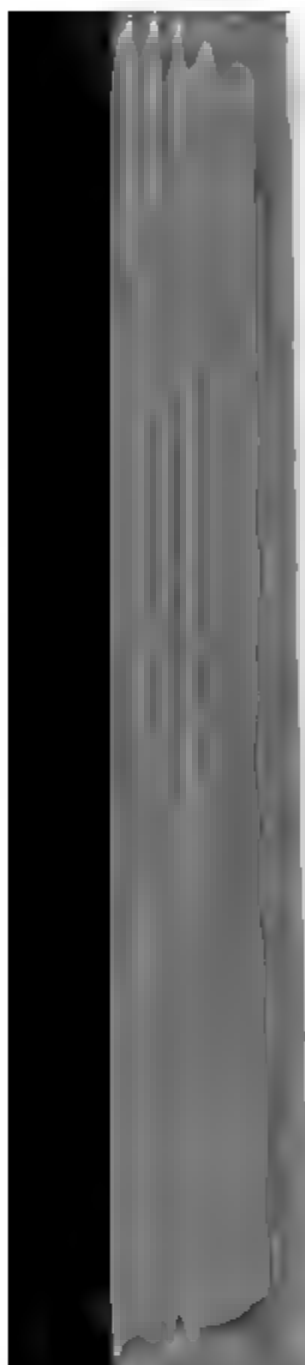
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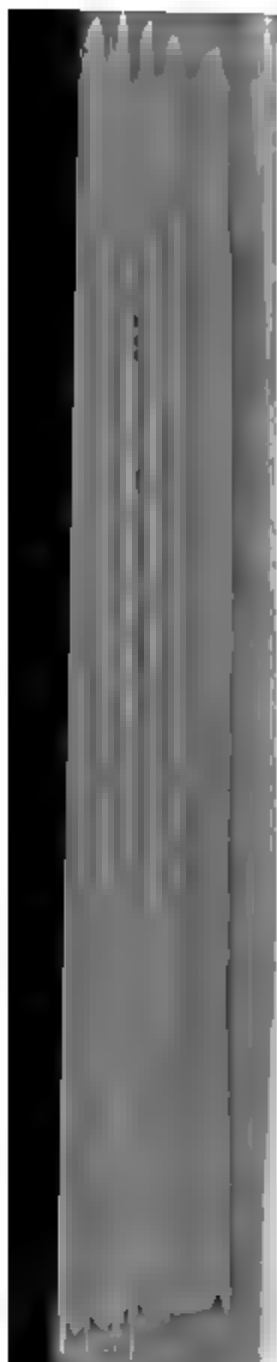
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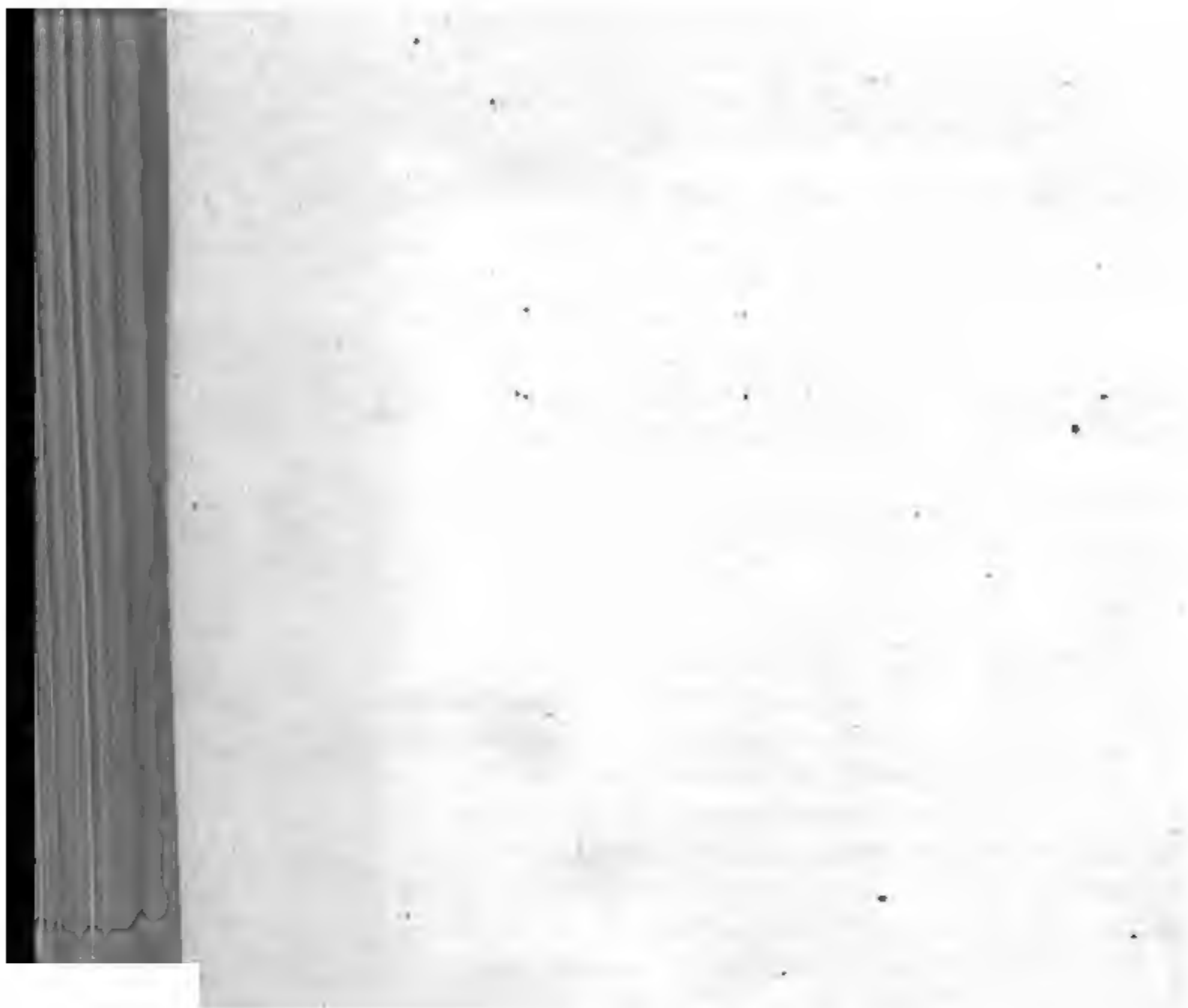
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